THE

ELECTRICAL REVIEW.

VOL. LXVII. NOVEMBER 4, 1910. No. 1,719.

ELECTRICAL REVIEW.

Vol. LXVII.] CONTENTS: November 4, 1910. [No. 1,719.

	Page
Electrical Plant for Steel Works and Collieries	729
Metalite, Limited	730
Electrical Contractors' Grievances	730
Free Labour Congress	731
Engineering and Civilisation	731
Prosperity in the U.S.A	732
"Twenty-seven Millions—"	732
Small Motor Drives: The Unappraised Factor (*illus.*)... ...	733
Correspondence:—Trade Suicide	733
Tests on Bitumen Cables.—Bringing Them Together ...	734
The Association of Mining Electrical Engineers	734
Lightning Conductors.—Holborn Street Lighting ...	734
Municipal Trading	734
Earthing Regulations in Practice	736
A New Traction Motor (*illus.*)	736
New Electrical Devices, Fittings and Plant (*illus.*)	737
Legal	738
Proceedings of Institutions:—	
Large Gas Engines and their Troubles	739
The Self-Propelled Vehicle	740
Electrical Progress in the United States	740
Fire Prevention in Germany (*illus.*)	742
The Less Important German Firms	743
Business Notes	743
Notes	751
City Notes	754
Electric Tramway and Railway Traffic Returns	756
Stocks and Shares	756
Share List of Electrical Companies	757
Metal Market.—Fluctuations in October	759
The Book-keeping and Accounts of Telephone Undertakings	759
Reviews	760
Electricity and the Panama Canal.—I. (*illus.*)	761
Uses of the Induction Balance and its Applications in Telephony (*illus.*)	764
The Demand for a British Empire Trade Mark	765
The Right to Alter the Price of Electricity	766
On the Winning Side	767
Foreign and Colonial Tariffs on Electrical Goods	768
New Patents Applied For, 1910	768
Abstracts of Published Specifications	768

Contractors' Column... Advertisement pages xxii, xxiv and xxvi

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address.: "AGENRAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 983; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 1l. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).
1911 EDITION
NOW IN PREPARATION.
H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London E.C.

ELECTRICAL PLANT FOR STEEL WORKS AND COLLIERIES.

THE result of the Appeal Case by which the Ilgner Patent No. 7,188, 1902, relating to improvements in the control of electrically-driven reversible rolling mills, has been declared to have no subject matter, is of very considerable importance in connection with both steel works and collieries. The decision in question has a more immediate bearing on the former than the latter, but as the combination of a fly-wheel with a varying-speed motor is the chief portion of the patent, it has, to our mind, equal application to colliery winding as to rolling mills.

In this respect, therefore, the combination known as the Ilgner system is now, to all intents and purposes, open to every electrical manufacturer. Many manufacturers had declared that there was nothing to prevent them from utilising electrical machinery in a combination similar to the Ilgner, but the declaration of the Appeal Court effectually clears the air and disposes of any potential claims for royalties.

While there has been, during the last few years, a moderately wide application of electricity in steel works, it is only within the last 12 months that the use of electricity on a large scale has been adopted by the British steel manufacturers. In this respect they have lagged very much behind their Continental *confrères*, but there are certain reasons which may be held partly to account for this. Primarily the somewhat unsettled state of the steel trade has been responsible, and we must further admit the conservative tendencies of our home manufacturers. There is, in reality, a good deal more electric driving in steel works than is generally supposed; but while we can point to fairly comprehensive schemes of electric driving in steel works in many parts of the country, the examples of reversible rolling mills driven by electrical means are still comparatively rare.

It is not difficult to give a number of cases of non-reversible rolls being driven electrically; indeed, there are some remarkably fine examples on the north-east coast, some of which have been carried out entirely by British electrical manufacturers. There remains, however, still a great deal to be done in this direction, and it is very satisfactory to learn that two or three of the largest steel makers in the country are seriously considering the details of schemes under which their works will be completely equipped for electric driving, the most significant item in such schemes being the utilisation of the electric motor for driving reversible rolls.

It is anticipated that gas-engine plant supplied with blast-furnace gas will be employed to a very considerable extent. As we have often pointed out, gas engines have been largely employed in many parts of Germany, and with very great success. It does not always follow that, because there

is an abundance of gas available, a gas engine scheme is always the best; indeed, there are steel works on the Continent where the original plant consists entirely of gas engines, but more recent additions have taken the form of gas-fired boilers and large steam-turbine units. However, the main fact that we desire to emphasise is that whether gas engines or steam turbines are employed, there is likely to be a very marked development among the steel manufacturers, in both England and Scotland, within the next two years, and it is to be hoped that the British manufacturer will obtain his fair share of the work.

It is hardly necessary to say that the application of electric driving to colliery work has gone ahead remarkably quickly during the last few years, but notwithstanding the great success which has been achieved in pumping and haulage, it has been considered by the British coal-owner that there are distinct limitations to the application of the electric motor to winding. It is true that the conditions in this country very often do not lend themselves to an economical electrical winding scheme on account of the very high capital costs of the electrical plant, but we think that colliery managers and engineers have been apt to generalise a little too hastily on the subject. It has been grudgingly admitted that electric winding has great possibilities when applied on a small scale, but it has been declared that in cases where two or three thousand tons of coal are raised from one shaft per day, the electric winder will not compare either in first cost or economy of working with the low-speed horizontal engine.

First cost has certainly been a very important factor operating against the electric winder, but with the re-arrangement of work necessary under recent legislation, it is becoming recognised, particularly in new schemes, that electric winding has very distinct advantages over steam winding.

We do not propose, at this juncture, to discuss the merits of the two systems, but it is pleasing to note that in certain cases where electric winding was previously condemned, the owners in the case of new sinkings have decided to put in electric winders, and these on a very large scale.

Here, again, is a direction in which we trust the British manufacturer will be able to give a good account of himself, and from information we have received, it would appear that in some cases, at least, the British coalowner is inclined to place himself entirely in the hands of the home manufacturer.

In comparatively old collieries, where it would not be worth while to change from steam to electric winding on account of the large capital cost, there is a strong tendency to put in mixed-pressure turbines to work in conjunction with the winding engines, and we have already noted several instances where most economical results are being obtained from such an arrangement.

Metalite, Ltd.

Proceedings at statutory meetings are sometimes limited to statements that such meetings are held as a matter of necessity to conform with the requirements of the law (an unexpressed but generally implied opinion that the law lacks wisdom pervading the meeting), and the directors expressing their cordial thanks to those shareholders who have been good enough to form the requisite quorum, and enable them to comply with a formality that might well be dispensed with. Occasionally, however, a statutory meeting is utilised with all seriousness as a means of enlarging on the promising features of an enterprise, the publication of the report of the proceedings forming a sort of supplementary prospectus. The statutory meeting of Metalite, Ltd., held on the 28th ult., was rather of the latter order. The chairman recounted that the minimum subscription of 150,000 shares had been duly applied for and 10s. per share paid thereon; he deplored the limitation of their existing manufacturing facilities whereby the company "had been regretfully compelled to refuse for delivery during the present season orders approximating to 980,000 lamps"; he dwelt on the "keen competition between various municipal corporations" to induce the company to build a factory "in their respective districts"—a competition which was only natural, as the business "holds out every promise of attaining to phenomenal proportions," which must mean an important development to the chosen town—and so on. The managing director succeeded the chairman, and indicated that the factory, which had been the subject of such keen competition amongst municipal authorities, had involved the investment of £7,000, but "the eagerness displayed by the various municipal corporations" had a very obvious reason—the potentialities were so vast that the establishment of their factories in particular districts "must inevitably add considerably to the prosperity of the respective localities." An analysis of orders in hand showed that when completed they would produce a net profit exceeding £160,000; this included, of course, several contracts spread over a term of years. A number of firms had intimated that they would confine themselves to the sale of British "Metalite" lamps—when the company was in a position to supply them with their requirements. Such facts must be a source of keen gratification to the shareholders, as they were to the directors, because "they prove that the public are being educated up to the fact that the British-made 'Metalite' lamp surpasses its rivals," and so on.

In the course of further remarks, Mr. Metcalfe said "he thought the shareholders would be delighted, at the end of the coming year, with the dividend that they would receive."

The statutory meeting is for the purpose of recording what has taken place since the incorporation of a company. In the case of Metalite, Ltd., the proceedings indicate that 150,000 shares have been allotted, and 10s. each subscribed; £75,000 is thus available, less such underwriting commission as may have been paid (9 per cent. was allowed for this purpose by the prospectus). The preliminary expenses payable in cash were estimated at £18,000. The net amount available for the purposes of the company would thus be approximately £50,000, and of this the shareholders must be gratified to learn that at least £7,000 has been invested in such tangible assets as lands and buildings. It will be well for all interested to remember that the nature of the dividend to be declared at the end of the coming year will be better known when that time arrives; in the meantime the report of the statutory meeting should be studied for its records of facts, and but little attention paid to inferences and prophecies.

Electrical Contractors' Grievances.

The members of the Electrical Contractors' Association (Inc.) held a meeting at Frascati's Restaurant on Tuesday afternoon last, to discuss a paper by Mr. Ratcliff on "Means to be Taken to Increase the Status and Efficiency of Our Association." There was only a small attendance, but those present fully appreciated the difficulties of the situation. At the present time the honest wiring contractor is attacked on two sides. On the one hand he has to defend himself against the attempt of the municipal electricity supply undertakings to wire premises and sell electrical accessories, using the rates as the financial basis of their operations,

and, on the other, against the unprincipled firms who carry out the shoddy work which does so much to bring electric lighting into disrepute.

The author of the paper, and all the speakers, agreed that the best method of proceeding was to insist upon a high standard of work from every member of the Association and *let that tell*. Instance after instance was cited of cases where wiring was carried out in defiance of all wiring rules, and was yet passed by station engineers and fire insurance offices. It was freely stated that in certain suburban districts from 50 per cent. to 75 per cent. of the wiring would not comply with the I.E.E., or, indeed, with any other effective wiring rules. Our own observations in some districts confirm this, and we are glad to note that the Association has deliberately decided to make a stand for good work. Various suggestions as to the best means of doing this were brought forward, and finally referred to a committee for further consideration. The question of rules was considered, and it was decided that it would be best to adhere to the I.E.E. Rules, and insist that not only the work of their own members, but also that carried out by municipal or other contractors, should be as far as possible made to conform to the same standard. In our opinion, this was a wise step; the I.E.E. Rules are now generally recognised, they are fairly well understood, and they form the standard of practically all the important fire offices.

Very little reference was made in the discussion to the skill of the individual workman, though much was said as to the need for careful inspection, but we think that a real need is the provision of some test of fitness for the workman and the general insertion in lighting specifications of a stipulation that all foremen and chargemen at least should hold a certificate of ability from some recognised centre—either the Electrical Contractors' Association, or some other representative body. In this suggestion the practice in other trades where much responsibility depends upon the individual worker is followed. If this were generally done, and the worker knew that the discovery of bad work might have serious consequences for his own reputation, as well as for that of his employers, he would have a direct incentive to see that all instructions given him were carried out in an intelligent manner. House wiring is to such a large extent carried out away from the employer's direct supervision that it is especially important that his subordinates should be technically competent and individually responsible. It is along this line that we feel the Association will carry on its most useful and effective work.

The Free Labour Congress.

The eighteenth Annual Congress of the National Free Labour Association has been held during the current week at the Memorial Hall, Farringdon Street, E.C., and, judging from the information before us, this Association appears to have been quietly doing a considerable amount of useful work during the past year. The Association was started in the year 1893, when a few Thames riverside workmen banded themselves together with the object of protecting their right to work free from the dictation and tyranny of trade unionism. Notwithstanding the antagonistic attitude of the existing Trade Unions, an Association has been built up which now numbers almost 800,000 members. The members claim to be free traders in the strict sense of the term, selling their labour in the open market, and obtaining the best terms they can get for it. They recognise that labour is a saleable commodity, and the law of supply and demand holds good in this department as in all others.

In his presidential address Mr. J. W. Roberts, of West Ham, put this pertinent question:—

> I would ask, is there any other section of the commercial manufacturing or business industry possessing, or assuming to possess, and exercising, the rights and authority claimed by trade combinations? For instance, is it permissible for the sellers of coal, iron, timber, cotton, silk, linen, leather, &c., to combine, and by means of picketing and so-called "peaceful persuasion," prevent or intimidate purchasers buying elsewhere than from members of the combination?

This is, of course, what Trade Unionists endeavour to do. That is to say, they try to prevent any workman who is not a member of one of the trade combinations from obtaining employment and selling his labour at any price whatsoever. Largely owing to the work of the Free Labour Association, the chief offensive weapon of Trade Unionism, namely, strikes, has been broken, and it is generally admitted now by Trade Unionists themselves, that, as the *Clarion* puts it, "strikes are played out."

The National Free Labour Association claims that during its 18 years' existence it has defeated 650 senseless strikes, the latest which it had a hand in breaking down being that on the North-Eastern Railway.

Judging by the remarks of the President, it would appear that the work of the Association is a somewhat thankless task, because, after its members have helped employers to keep their works going during strikes of Trade Unionists, and put up with intimidation, insults and violence, they are generally cast off as soon as the strike is settled, while the unionists are taken back to work on the old basis as though nothing had happened.

As we have pointed out many times before, Trade Unions are all very well when their operations are kept within their proper and legitimate sphere, and they have, as benefit societies, been of great service to their members. If in the future they decide to confine themselves to this beneficial work rather than seek to become a great political power and to dictate the terms upon which the manufacturing industry of the country shall be conducted, it is possible that they may yet arrest the rot which has set in, and which, unless checked, will prove fatal.

Engineering and Civilisation.

In his presidential address to the Institution of Civil Engineers on Tuesday last, Mr. Alexander Siemens discussed the share that had been taken by the engineering profession in bringing about the present state of civilisation, going back as far in history as the fifth century B.C. He pointed out that in literature, art and philosophy, we were even now not greatly superior to the ancient world, but in engineering enormous advances had been made. Progress had been due chiefly to improvement of the means of communication and to the saving of manual labour by the introduction of mechanical power, which had jointly resulted in a general lowering of the cost of "obtainables." On this last feature the President laid special emphasis, regarding it as the most important factor of modern progress. The fallacy of the workman's theory that labour-saving machinery makes for reduction of employment was ably demonstrated, as well as that of "restriction of output," which, by increasing cost of production, diminishes demand, and thus, far from reducing unemployment, actually has precisely the opposite result.

The infinite possibilities that lie before us were well exemplified by reference to Hertz's discovery of the propagation of electric waves, which has since given rise to wireless telegraphy, and the primitive knowledge of electricity possessed by mankind for nearly 2,000 years before its vast capabilities were realised; Mr. Siemens pointed out that our knowledge of the properties of radium was in a similarly embryonic condition, and plausibly suggested that in the future no less astonishing developments might arise from this source.

Following up his original line of thought, Mr. Siemens drew the inference that lowering of cost should be the guiding principle of all engineering design, and this led him to draw a broad distinction between contractors' work and manufactured products. In the case of the former, the engineer must be the real expert and provide the whole of the design; in the case of the latter, it was impossible for the consulting engineer to be familiar with the details of their manufacture, and the trained experts engaged in manufacturing processes must necessarily know more about them than outsiders.

Some engineers, it was said, took advantage of this circumstance by specifying results only, and utilising the proposals put forward by tenderers for the purpose of drawing

up complete specifications; apart from its moral iniquity, this led to waste of time, and it could not be stopped even by Act of Parliament, so long as the results obtained were satisfactory.

In this connection the excellent work of the Engineering Standards Committee was of great value, both to the consulting engineer, enabling him to specify suitable tests, and to the manufacturer, who was thus enabled to standardise his products. The Committee, however, must constantly extend the scope of its operations to new products, and revise the specifications already issued.

The rapid development in the motor-car industry, due to the removal of restrictions on speed, which had lead to the employment of thousands of British workmen, had, he thought, encouraged Parliament to pass the Patent Act (1906), making the working of patented inventions obligatory. This Act, in the author's opinion, did nothing more than carry out the spirit of the original Statute of Monopolies of 1623, which was designed not so much to encourage invention as to establish new industries in this country. Progress was not the result of flashes of genius, but of patient plodding work and careful study; for this reason the colleges should occupy themselves mainly with teaching science—that is, the natural laws upon which the art of engineering, or of any other profession, is based.

Finally, the President foretold the extension of standard specifications to international agreement, which is already being carried out in the domain of electricity, and the eventual adoption of the metric system in this country, concluding a thoughtful and illuminating address with an exhortation to his hearers to continue without slackening their efforts for the advancement of civilisation, which had been so fruitful in the past.

Prosperity in the U.S.A.

Elsewhere in this issue we give an abstract of the inaugural address of Mr. J. S. Peck, at the first of the meetings of the I.E.E. this session. The address is of exceptional interest, as illustrating the remarkable contrast between electrical manufacturing conditions in the United States and those obtaining here.

Many of the differences are, of course, due to purely natural causes, such as the development of power transmission over very great distances at extremely high pressures, in order to utilise the water-power with which the country is so abundantly endowed; but others arise out of social conditions which might equally well exist elsewhere.

An output of no fewer than 1,000 watt-hour meters a day from a single factory, for example, represents a rate of development which is simply amazing; the progress made in electric traction on railways also excites our envy. We have, however, boundless faith in the future of electricity in this country also, and we look forward to the day when all our works will also be employed to their utmost capacity. In the meantime, we commend the address to the notice of our readers.

"Twenty-Seven Millions——"

We were interested the other day in a letter written to the *Times* by Mr. A. Mosley on the importance of there being established some kind of State supervision of concerns in which the public invest their money. Those who, by study of prospectuses, or by experience, know something of the pitfalls that are prepared for the unwary by the promoter of the undesirable class, are generally on their guard against the affectionate advances of these gentlemen. Furthermore, such people have learned the wisdom of geographical distribution, and if they incur a loss—well, it is a loss, and there's an end on 't. What they lose on the swings, they make up on the roundabouts as, to mix the metaphors, they do not put all their eggs into one basket. But what of those who have not learned the lesson, who know nothing of the pitfalls, who still believe every man honest until to their cost they find him otherwise? These are not warned by the criticisms of financial papers, for such seldom appear, and, when they do, are not seen by the gullible sections of the community. The establishment of an effective supervision is a subject bristling with difficulties, but something must be done sooner or later for the protection of the public against itself. That uninitiated old people should risk their life's savings in the hands of a man who offers a high rate of interest, is as pitiful as it is remarkable in these generally hyper-suspicious days. The mere offering of the high rate of interest stamps a concern as unsound. If only that lesson were learned well, and the people would rest as contented as they can with a small percentage return on an intact capital, there would be no need for more protection than obtains at present; but how to get that lesson learned—that is the question! We cannot help thinking that if our daily newspapers and financial Press would indulge in a little more independent and sweeping criticism, instead of publishing just what prospectus advertisers tell them to say (the printed "editorial notice" that accompanies the prospectus, to wit), rottenness would be exposed in more cases than it is, and investors would be saved even after their applications had been put in. It is scandalous that the gullible ones should be ruined because of their ignorance; yet can we find a workable remedy without putting a restraint on enterprise? We trust that the suggestion in the *Times* correspondence will not be allowed to pass unnoticed. We are not eager for the protection of those who knowingly indulge in a speculation, as most people were doing during the rubber craze recently—if they lose, they have themselves to blame; and always there is the subsequent punishing power of the law for the offender to reckon with. We are concerned for quite another class, as we have stated. We should like to see the whole question threshed out to decide, once for all, whether something cannot be done. There is another aspect of the matter which must not escape attention. It is not only the helpless investor who suffers from unsound concerns being foisted upon the public by means of prospectuses filled with extravagant claims and promises. Industries may receive a set-back as the result of public confidence being shaken through money being lost. For a variety of reasons electrical affairs do not possess that glamour that once lured investors like bugs round an American arc lamp. We ought to see to it that only sound propositions are allowed to pass through the public subscription stage, or electrical securities will be dragged still further into disrepute. But if the newspaper press is silent when it ought to give wide publicity to expert electrical criticism, the latter may come to pass.

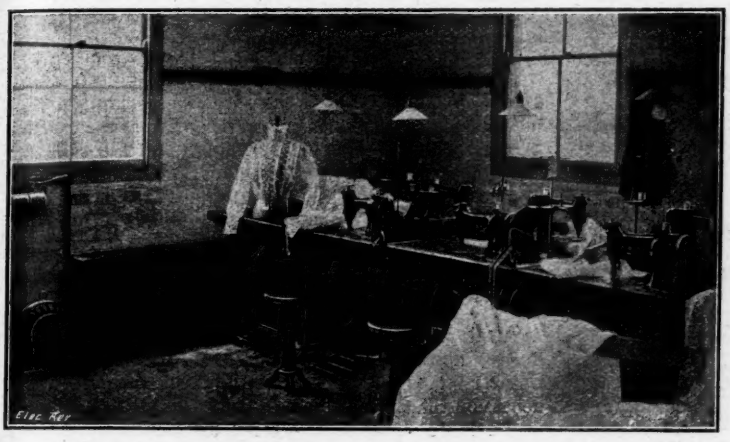
German Enterprise in Austria.—It is reported that the works of the Austrian Bergmann Electricity Works Co., which was formed by the Bergmann Co., of Berlin, about a year ago, to establish manufacturing plant at Bodenbach, has already made considerable progress. The metal works and the insulating materials factory have already started operations, and the cable factory is expected to be opened this year and the machine works in March, 1911. It is stated that the orders already on hand will occupy the departments now at work for a considerable time. An installation department and sales organisation have been established in Vienna in conjunction with the Bodenbach Works, in which about £166,000 is being invested, although the ordinary capital was originally fixed at only £20,000.

Application for Patent Extension.—The Lodge-Muirhead Wireless and General Telegraphy Syndicate, Ltd., 7, Cartaret Street, Westminster, is applying for an extension of letters patent granted to Oliver Joseph Lodge, of Liverpool, in 1897 (No. 11,575).

SMALL MOTOR DRIVES: THE UNAPPRAISED FACTOR.

The small drive is distinguishable from the bulk of work capable of being electrically driven, by a factor somewhat difficult to appraise directly, or indeed at all except in terms of something else.

Hitherto the electric motor has won its chief victories in supplanting power machinery of one kind or another, the commercial value of which can be estimated directly in money. It has now, by diminishing its power—stooping to conquer, so to speak—got firm foothold in another field, viz., that of the treadle and the hand-wheel in their numerous forms. In other words, it is attempting to abolish the human hand and foot as producers of power. What is the precise money value of the human hand or foot in this connection?



Motor Driving 32 Sewing Machines.

The field is a very large one. The little things of life are more numerous than the big, and this field presents an inexhaustible source of interest to the inquiring mind (and, incidentally, an inexhaustible source of business for the makers of small electric motors). Even a generic, as opposed to a specific, list of small machines hitherto driven by hand or foot, which can be driven by the small motor, would run into hundreds of entries for every ten in the large power field. Take, for example, a dentist's operating room only (leaving the workshop out), that excruciating instrument the drill, with the grinder, buffer and saw, represents calls for power as persistent almost as the patient's prayer for it. A very diminutive motor will do all this work, not, indeed, setting free the dentist's hands, which are free already, but, what is almost as important, as every workman knows, setting his feet free; for without a good steady purchase with the feet, the rest of the man when standing loses efficiency and frequently temper. Take, again, the routine work of a big hotel: from kitchen to attic we get a long list of small jobs usually done by hand, to almost all of which the motor can now be applied; knife-cleaner and grinder, silver polisher, dish and clothes washer, peeler, crumber, chopper, mixer, carpet-sweeper, massager, hair-drier, &c., not to speak of the mechanical piano-player and the cue-chalker. A working jeweller's presents a similar list of possible small motor drives; and the dozens of other crafts, trades and industries present like lists just as possible. And the factor throughout which calls for appraisement is merely the value—even approximate—of the displaced foot, hand or finger, or all three, operating the machines.

The British Westinghouse Co., who are now specialising in small motors, tell us that they recently installed a 3-h.p. motor for driving 32 sewing machines at a North London blouse maker's, and interested themselves in investigating the results. What the motor here replaced was precisely 32 girls' feet. Here was a case apparently simplicity itself. Yet when it was attempted, for the purpose of comparison with the motor, to put a money value on the particular form of power displaced, this could not be done directly; for the power displaced in such cases is a mere mechanical by-function of the skill actually employed to do something quite different, namely, to stitch blouses carefully according to pattern, and in a given time, an indistributable component of that work. (Incidentally, the sagacious small-motor salesman would therefore, it appears, be well advised to drop that end of the stick altogether, and talk in another direction.) The Westinghouse Co. asked the proprietor of the above factory to put a figure on the difference in money-making value of each sewing machine after the electric motor was installed. The reply was that, roughly speaking, each machine was worth 5s. to 10s. a week more, according to the amount of work going through, that is, taking all components: speed or quicker output, and better product by reason of greater attention and care given to the work.

As £8 per week—taking the lower figure given—appeared to be a remarkable addition to profits, the proprietor was asked how the capital cost had been distributed, and what was the cost of electrical energy, upkeep and repairs. The reply was that these things were not worth considering. Allowance had been made for what was called the *real* additional expense—*i.e.*, the cost of electrical energy per week—which had been deducted. The electric motor never went out of order and never required attention. So the precise statistician was here again stumped. As a matter of interest, the actual capital cost involved—which had been written off at once in a lump—covered motor, main shaft, countershafting, and cone friction clutches attached to the treadles for throwing the machines in and out of operation. This total capital cost, liberally estimated at £48, would disappear at the end of the sixth week, and future work would apparently bring in the clear additional profit. Apparently it is only in the Law Courts that the money value of a hand or foot can be accurately appraised.

A corner of this blouse-maker's factory is shown in the accompanying illustration, showing how the motor drive was carried out in this instance.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Trade Suicide.

A most extraordinary case of unfair trading has recently come to my notice. A certain manufacturer of metal-filament lamps has recently introduced a scheme providing that lamps bought from him are not to be resold under list prices. This is most excellent, and one would think that the tradesman, that is to say, the middle-man, who has to live by the profit that he makes out of the resale of goods, had at last come into his own; but, strange to relate, it is found that this very firm is itself offering to houses of business not even remotely connected with the engineering trade, and who only buy lamps for their own consumption, exactly the same trade terms as it gives to the genuine tradesman. That is to say, the manufacturer constitutes himself a most formidable competitor, depriving the tradesman of his power to use his judgment in quoting for lamps at a discount, enabling him to compete with other firms, and at the same time going behind his back, and offering the full discount to the unfortunate tradesman's customer.

Is it not time that some strong combination in the electrical trade were formed to look after the interests of the middle man, who ought to be, if only allowed to make a

bare existence, the manufacturers' most useful agent? The argument used by the manufacturer in the present case is that he gives discount to these firms—who may be tea factors, butter merchants or collar manufacturers—because, forsooth, they have an engine to drive their machinery, with a man to stoke the boiler—in other words, an engineering staff and plant!

If this extraordinary method of trading interests anyone concerned in trying to organise, in a sound manner, the trade connected with electrical engineering, I shall be very happy to give him full particulars.

W. P. Adams.

London, S.W., *October 25th*, 1910.

Tests on Bitumen Cables.

With reference to a letter by "Mains" dealing with the above article, I am indebted to him for his appreciative remarks and for his criticisms, which I will proceed to deal with.

I cannot inform him as to the composition of the soil which I experimented with, as I am not a chemist. It contained very little clay, cinder or sand, and was what I might term inferior garden soil. This soil was artificially kept very damp during the test, which extended over a fortnight; and in spite of this excess of moisture, the $\frac{1}{16}$-in. hole through the insulation apparently closed up, as shown by the high insulation resistance obtained at the end of the test. His remarks regarding the temperature curve (fig. 1) are quite correct, but I do not consider the curve valueless from a practical standpoint. It shows clearly how the soil surrounding a defective cable may become very hot and dry in course of time, thereby reducing the amount of current flowing to earth. His suggestion regarding the test shown in fig. 2 is a good one. My only objection to it is that a variable resistance suitable for obtaining exactly the same current at either end, might not always be available. The formula given is, of course, easily simplified, but was given in full, so as to show at a glance how it was arrived at.

Dealing with Mr. D. Hilton's remarks which appeared in your issue of October 28th, I have had little experience with bitumen and paper-insulated concentric cable. Cable of this class will probably have a large proportion of paper to bitumen. The paper on the cables with which I have most experience was only one or two layers in thickness. It is used simply to keep the wires clean and to prevent any decentralisation of the cable due to possible softening of the bitumen. The chance of moisture creeping along cable of the kind just referred to, especially when laid solid in compound, is very remote.

W. A. Toppin.

Bringing them Together.

I note, with feelings of amusement and lively appreciation, "Degede's" kindly suggestion to the "Expert" with reference to the Aberdare appointment!!! in the current issue.

Might I suggest that this modest, yet accomplished, gentleman should retain his berth, where "he is engaged at present and is giving satisfaction," and accumulate yet a little more "filthy lucre," when he could then negotiate (with a view to purchasing outright) with some lucky holder of the £200 per annum appointment he requires.

I am perfectly willing to accept the remainder of the reward for my suggestion, with the comforting thought of a duty fulfilled.

Mariner.

The Association of Mining Electrical Engineers.

With further reference to this matter, my reason for not continuing this discussion is not because I *have no heart* to do so, as stated by "Non-Council Member," or because *I cannot answer the questions*. I consider I am fully competent to carry on a discussion without the aid of any other person to help me.

I again say that I will not enter into a discussion by correspondence with anyone who does not apparently know anything of the doings of the Association, and who also makes wilful misrepresentations in his correspondence.

I offered to meet "Non-Council Member," and enter into a discussion with him. He refuses this. "It would be absolutely stifled by the opposition," he says. What opposition? I can almost anticipate his answer, "The colliery managers'." Now, I am prepared to give a guinea to the Electrical Trades Benevolent Fund if he can prove any meeting, council, or branch (except Cumberland branch) meetings where colliery managers have either been in the majority or even strong enough to oppose any proposition put forward by electrical members. The same offer is open if he can prove his false statement that the colliery electrician was only asked to come in after everything had been arranged about the colliery manager member by the promoters.

I am prepared to let the Editors of this journal decide these points.

This is my final letter, and I conclude the same by saying that I will do all I can towards the consummation of the original objects for which the Association was founded, and which I am convinced will take some little time to achieve.

The Editors of this journal criticise our Association. I reply to same, and they express no further comment. Am I to understand that their silence means accordance with my views?

A Council Member.

Lightning Conductors.

I feel an apology is due to "A. W. P." for my apparent neglect in replying to his suggestion in the Review of October 7th, that I should endeavour to arrange a public debate on the above subject.

I am afraid, however—if my experience is anything to go by—that a public debate is not quite the best method of getting the information I would like, for each speaker apparently sets himself out to make a formal speech on things in general, instead of sticking closely to the point at issue. Besides, if we had a debate arranged by an Institution, we should have a lot of people there in evening dress looking awfully solemn and intelligent, and everything would have to be arranged in a very high and lofty style, whereas the informal gathering mentioned in my earlier letter would be conducted on quite different lines. I can imagine, for instance, Mr. Hands saying to me—as I repeat for Mr. K. Hedges's benefit the well-worn formula "Say when"—"Look here, old chap, don't believe those tales about iron conductors and all that sort of thing; they come from Birmingham, and you know what Birmingham is famous for."

No! I think we cannot do better than hold our little meeting at, say, "Simpson's" or the "Coal Hole."

W. H. B.

Holborn Street Lighting.

Referring to the paragraph in your current issue on the above subject, in which it is stated that the Committee of the Holborn Borough Council have given directions that the Metropolitan Electric Supply Co., Ltd., and the County of London Electric Supply Co., Ltd., should be invited to make a public demonstration in street lighting, I should be obliged if you would allow me to point out that with these companies should be associated the Charing Cross, West End and City Electricity Supply Co., Ltd.

E. Cunliffe Owen,

Secretary, Metropolitan Electric Supply Co., Ltd.

London, W., *October 31st*, 1910.

Municipal Trading.

Mr. Bostel's letter is not without interest, as it clearly shows the spirit that leads to the strained relations existing in so many towns between the central station and the local contractors, viz., the calm assumption that the supply officials are the only persons with any knowledge of electrical matters, and that all others are either ignorant or wilfully careless in their methods. His expression of opinion is not without interest to Birmingham contractors who are constantly meeting him in his capacity as a subordinate

member of the Birmingham electric supply commercial department, and when next we meet, the writer will be wondering whether he is esteemed (?) as one of the 90 per cent. so dogmatically damned; further, one is tempted to ask how far he expresses the opinions of his chiefs. He writes glibly of the vast sums paid by supply departments towards the relief of the rates, but inquiry will, I think, show that there are many more stations in debit than in credit to the rates. Mr. Bostel and myself would be better employed in getting together and working together in the interests of the Department, the Consumer, and the contractor (this last word in very small type, please, Mr. Comp.) than in rushing into print in unkindly criticism of each other, and the Consumer might well say "a plague on both your houses." In conclusion, I would submit that contractors generally are an industrious, hard-working, and conscientious body who bring to bear on their contracts the fruits of an experience that has taken years to gain, and that, generally speaking, the advice they give the consumer is at least as sound as that given by sales or consumers' departments' assistants.

A Birmingham Contractor.

Birmingham, *October 28th*, 1910.

In your last week's issue it was refreshing to note that one of my shots had gone home, but with regret, be it noted, that it did not find a better target. Nevertheless, it rankles in the breast of Mr. A. C. Bostel, whoever he may be.

I assume he must be an aspirant to municipal honours, yet was not aware that he had any official significance; and on referring to several well-known municipal officials we find, as might have been expected, that they refuse to recognise either Mr. A. C. Bostel or his statements, which possibly accounts for his time-worn and thread-bare platitudes, which in his case are hard to discern from general insolence.

I was not aware that I was privileged and honoured with a monopoly of the contracting industry. That aside, however, he admits that the Bill is for the purpose of providing a side line for municipal engineers. Exactly, I am satisfied.

Duncan Watson.

London, W., *October 31st*, 1910.

I have perused with interest the correspondence on this most important subject, and should be glad if you would kindly allow me space for a few remarks.

In the first instance, I will take Mr. Duncan Watson's case, and would like to ask him the question, "How many contractors of the present day have sufficient capital at their disposal to allow of their maintaining an efficient publicity and business-getting department, including the employment of efficient and capable representatives?" I doubt if there is to be found a contractor who is conducting a vigorous and up-to-date campaign against our great rival the gas industry, in any of the cities and towns possessing municipal electricity supply undertakings; in fact, with the majority of the contractors, the prevailing practice is to step in after the supply authorities have done all the pioneer work required in securing a consumer, and thus reap the benefits of the supply department's labours.

We hear on all sides of the very low prices to which wiring work has been cut, and who have the contractors to thank for this? Themselves. When the Electrical Contractors' Association was formed it was understood that one of the principal objects of the Association was to protect the trade, and, as far as possible, to ensure that profitable prices were strictly maintained, but even here we find that members who have pledged themselves to all intents and purposes to be loyal to the Association's objects, are cutting each other wherever an occasion arises.

I agree with Mr. Bostel on several points, as it certainly is hard for municipal supply departments, after pushing for and securing consumers, to have to leave them to the mercy of Mr. Contractor as regards the wiring and installation work.

On the other side of the question, everyone will agree that there is no doubt that if the publicity and consumers' departments (which have now reached such enormous proportions) in connection with some of the large municipal supply undertakings were considerably curtailed, and the heavy cost of upkeep devoted towards reducing the price of electricity, thus bringing it to a more competitive figure with gas, a much greater increase in consumers would be obtained than at the present, for after all is said and done, the question of cost is, in the majority of places, the greatest stumbling-block to obtaining increased business.

What is evidently required in order to put electricity on an equal competitive footing with gas, is that the very stringent rules of the various supply authorities and insurance companies governing the supply and use of electricity should be dispensed with. When a supply of gas is required, the prospective consumer has not got to obtain a form and list of rules and regulations, each one of which, in the majority of cases, he is at an utter loss to understand, but makes application, when, providing references, &c., are satisfactory, or the required deposit has been made, the necessary arrangements regarding the piping and fittings are carried out, and the premises are connected to the supply.

Instead of applying to Parliament for powers to execute wiring work (which it is hardly to be expected they will obtain), the Municipal Electrical Association should endeavour to follow on the lines working so admirably with the various waterworks departments and companies all over the country, whereby all plumbers are required to be examined, certified and duly authorised by them, before being allowed to execute any works appertaining to the supply of water from the town main.

If the Association formulated a scheme which required that all contractors should pass a prescribed examination before being permitted to carry out installation work, it would dispense with the present formidable rules and regulations, put a check on all price-cutting, and the jerry work so often complained of, and would undoubtedly strengthen the forces of electricity in the great and increasingly strenuous fight with gas. It is useless trying to educate the would-be consumer in the various uses of electricity if the contractor is to be allowed to execute work without giving a thought to the efficiency and economical side, from a consumer's point of view, and at the same time, on the other hand, it will be very hard on contractors if they are compelled to pay rates to help to support a monopoly which is vigorously engaged in endeavouring to wipe them out of existence.

J. E. Thompson.

Warwick, *October 30th*, 1910.

Most of your correspondents, with the exception of Mr. Bostel, appear to have missed the whole point, and have relied mainly on what appear to me to be selfish arguments. I would like to add a few words from the point of view of a manufacturer.

You will, no doubt, remember with me that in the early stages of this industry, practically the whole of the mounting or fitting-up of electrical work was carried out by manufacturers. In those days it was necessary, as there was no such person as is now understood by "the contractor." This type of individual was gradually evolved, owing mainly to the fact that the amount of work increased beyond the capacity of the manufacturer, and to the work in many cases having to be carried out in places far from the manufacturer's place of business, and also because the work of the contractor required little technical knowledge compared with that which the manufacturer had to employ and supply.

Nowadays the conditions are somewhat changed, and the contractor should have that sufficient technical knowledge, but my practical experience is that in 99 cases out of 100 he does not possess it. Moreover, the manner in which certain supply houses grant indiscriminate credit, &c., has favoured the growth of a class of contractor, unfortunately in the majority, who possess neither adequate capital nor sufficient knowledge and experience of conducting the business, to advance the interests of the electrical industry in anything like the ratio to which the importance of the industry has now grown. As a result, and naturally so, the central station manager has had to take the bull by the horns and conduct the business himself.

I know of my own personal knowledge several municipal authorities and private supply companies who would gladly

give up their showrooms and contracting business if they dare, but they know that if they did, the whole of the industry, as far as they are concerned, would fall off, as there are none competent to take their place. Moreover, from the manufacturer's point of view, the ordinary contractor is a most unsatisfactory individual to deal with. Take the case of a manufacturer of a special apparatus which is worked electrically, or is of itself an electrical apparatus. He wishes it taken up and pushed in a proper manner. If he approaches an ordinary contractor, this person will usually throw cold water on the matter, or will probably offer to take it up upon considerable payment, and even then in nine cases out of ten the result is a failure—at any rate, so far as the manufacturer is concerned. On the other hand, if the supply company take it up, they will push it in a proper manner for two reasons: first, because the ordinary profit is attached to the transaction, and, secondly, because each customer they make for the apparatus or article is an extra customer for the current supplied.

You will find that these matters right themselves and find their own level. The municipal Corporation or private electricity company will not trouble itself with a contracting department unless need for it exists, and the remedy against such a department being started rests almost entirely with the contractor.

Manufacturer.

Earthing Regulations in Practice.

Your correspondent, in his article *re* the above, raises a very important point, which is only too often completely overlooked, and that is, the absolute danger incidental to the use of slip-joint metallic tubing, which is neither properly earthed nor mechanically and electrically continuous.

The writer knows of several installations, one in particular—a large mansion, the residence of a well-to-do merchant, where, in other respects, no expense has been spared to make a first-class job, but in the installation of the electric light, the contractor—who, I believe, was not limited in price in any way, has installed slip-joint tubing, and this without even cleaning the joints or making any pretension to the proper earthing of same. The result is that the installation is highly dangerous, and it would not surprise me in the least should there be a fire there at any time, and yet the owner is in delightful ignorance of the risk he is incurring, and thinks that every safeguard has been adopted.

With regard, however, to the suggestion of your correspondent that it may be worth while to consider the earthing of the tubing only when fixed within reach in wet places and keeping the remainder in isolated single lengths by the use of fittings and sockets which actually insulate, I am afraid that this would be a very poor remedy, and would, in the majority of cases, be most unsatisfactory and highly dangerous, owing to the possibility of the insulated lengths of tubing becoming fully charged, and thus conveying the current at full pressure to any gas pipes or bell wires that may inadvertently be in contact with them. Only recently, the writer came across an instance where this had occurred; a short length of insulated tubing had become fully charged, a bell wire was in accidental contact, and some distance away, underneath the floor-boards, the same bell wire was in contact with a gas pipe, with the result that immediately the tubing became charged, a hole was burnt in the gas pipe and the gas set on fire; fortunately the fire was discovered in time and the gas turned off at the main, otherwise the house would probably have been burnt down.

The writer has had an extensive practical experience in the testing and inspection of all classes of wiring and wiring faults during the last 15 years, and must say that he has come to the conclusion that for dry situations there is nothing that can at all compare, taking everything into account, with the old-fashioned wood casing, and in damp situations where wood casing is unsuitable, with solid drawn screwed tubing properly earthed, and he ventures to think that that abomination, the slip-joint metal tubing, should not be tolerated except where cheapness is the one and only factor to be taken into consideration, blindly regardless of all consequences.

J. E. D.

A NEW TRACTION MOTOR.

In *La Lumière Electrique* for August 20th, there is a long article by M. Paul Bary, in which is described the "B.V.D." traction system, consisting of an electric motor and controller of novel design, which formed the subject of patents recently granted to Mr. H. B. van Daalen, of London.

The system has been developed particularly for self-contained electrical vehicles of the battery type, but it is, of course, also applicable in the case of tramway and similar vehicles obtaining power from an outside source.

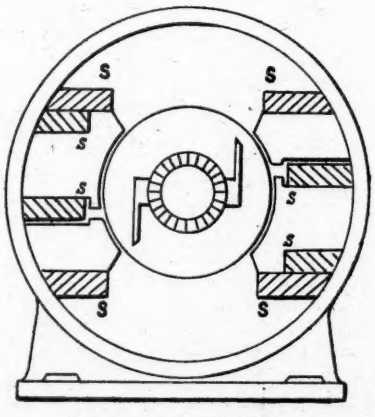
The system is claimed to lead to economy in energy consumption in the motor, owing to correct commutation at all speeds and to the possibility of recuperation whenever speed is reduced or when going down hill; also in the case of the controller, which is so designed that the current is never interrupted.

Economies in manufacture and maintenance, and an improved efficiency—which in a 5-H.P. B.V.D. variable-speed motor, has officially been found to be 83 per cent.—are also claimed.

The novelty in the motor is in the arrangement of the pole pieces and excitation circuits.

It is pointed out that in the ordinary commutating-pole type of motor, both the main and auxiliary poles produce their own fluxes, giving two distinct maxima, between which commutation, though approximately correct, is never perfect, especially where great variations in speed and E.M.F. are found.

In the B.V.D. motor, the shunt and series field windings are superposed one on the other with the axis of each winding passing through the other winding, but not coinciding; the effect is to produce one nearly uniform flux, the position of maximum density, however, varying according to the relative strengths of the currents in the two windings.



Section of B.V.D. Motor.

This automatic movement of the position of maximum flux density is arranged to compensate exactly for the opposing effect of the flux produced by the armature itself, so that the brushes will remain stationary and always occupy the correct position on the commutator.

The motor has been tested, both in this country and France; in the latter country by M. Paul Bary, ex-chief of the works of the Central Laboratory of Electricity, Paris, who, in a test of an 85-volt 50-ampere motor in which speed variation was obtained by varying the shunt current from its maximum of about 4 amperes to zero, obtained a speed variation of from 540 R.P.M. to 1,700 R.P.M., the load on the motor and motor current increasing at the same time from 20 amperes to 65 amperes, in order to obtain conditions analogous to those in which the motor would operate on a car, and the shunt current decreasing as stated above.

These results were confirmed by similar tests carried out at the Central Laboratory.

M. Paul Bary remarks that no sparking was observed, and the position of the brushes was not altered. The speed variation was obtained by rheostatic control only.

The Central Laboratory also tested the efficiency of the motor, and under normal running conditions, at 85 volts and 50 amperes, the efficiency was found to be 82·8 per cent.

In a test carried out in this country by Mr. W. G. Walker in April last, energy was supplied from an ordinary cab battery of 42 cells.

The motor was run under varying powers and speeds, ranging from 0·98 B.H.P. to 6·06 B.H.P. and 540 R.P.M. to 1,672 R.P.M.; careful records were taken, and the B.H.P. was obtained by the Walker dynamometer. The report states that at 5·45 B.H.P. and 1,672 R.P.M. the maximum efficiency recorded was 86 per cent., and at 2·36 B.H.P. and 837 R.P.M. the efficiency was 83 per cent. No sparking occurred throughout the whole series of tests.

The patented controller used in the B.V.D. system provides for the successive cutting-out of series resistance and introduction of shunt resistance, and *vice versa*, by the operation of one handle.

At the highest speed the motor has only the series winding in use, and if the shunt excitation current is wholly or partly re-established, an electric braking action on the motor and car results. The system is, therefore, recuperative, and it possesses the further advantage that the whole range of speed is obtained without the coupling of motors, and that the controller contains only one brush which is traversed by the main current, thus avoiding the numerous contacts found in controllers working on the series-parallel system.

A Georgian Design in Aston Non-Luminous Radiators.

The Pembroke Lantern.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Veritys' New Lighting and Heating Manufactures.

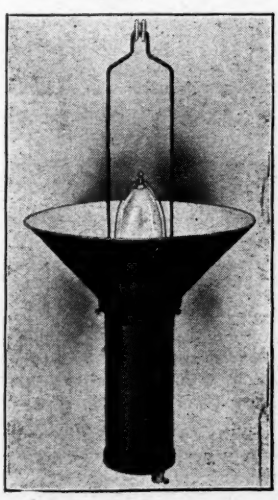
Messrs. Veritys, Ltd., whose products, as most of our readers in all parts of the world are aware, cover a wide range of electrical manufactures for lighting, power, heating, &c., are placing a number of new designs on the market for the current season's requirements. Of their "Radiant" lanterns, which are covered in publication No. 626, little description is needed; a type known as the "Pembroke," and fitted with Z metallic-filament lamps, is illustrated in the next column. This carries four 100-C.P. lamps, measures 14 in. (lip), and is supplied in zinc, painted grey, and with cast-iron rings. Among the types shown for shop, office, and railway station lighting, the "St. Martin's" appears. This is a type adopted by the General Post Office; like the "Pembroke," it contains four 100-C.P. Z lamps, is 14 in. lip size, but in finish it is copper stove enamelled black

for the purpose of matching decorations of different periods. The Aston electric cooking apparatus is also illustrated and priced in this pamphlet.

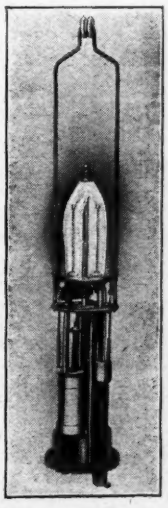
Publication No. 124 describes the "Veriflam" flame lamp, formerly called the "Flambo." The firm have dispensed with the abutment formerly used in this lamp, which is also free from any complication of clockwork, and does not depend upon a brake wheel. A special feature claimed is that the "Veriflam" lamp will burn cheap carbons, resulting in a saving, while there are no disagreeable fumes given off. We may allude, lastly, to Messrs. Veritys' inverted-enclosed and photo-printing arc lamps. A special lamp has been introduced (see list 630) for photo-printing purposes, suitable for taking blue prints in offices, &c. It is fitted with negative attachment and cylindrical globe; we illustrate it below. The best effect is given on 120—250-volt circuits, continuous or alternating. The inverted lamp, which is suitable for drawing offices, shops and showrooms, has no obstruction between the arc and the ceiling.

Westinghouse Drum-Type Controllers.

The British Westinghouse Electric and Manufacturing Co., Ltd., of Trafford Park, Manchester, has standardised a series of reversing drum-type controllers for motors driving cranes, hoists, machine tools, textile and other machinery; these controllers, which are described in catalogue 60/1A, are of the single-handle type with mica insulation, in accordance with Admiralty requirements, and each part is standardised and interchangeable, so that repairs and renewals can easily be effected from stock. Strong construction and ready accessibility are features of the design, and the best material and workmanship are employed. The drum rings, finger bases and switch parts are all clamped on mica-insulated



Inverted Enclosed Lamp.



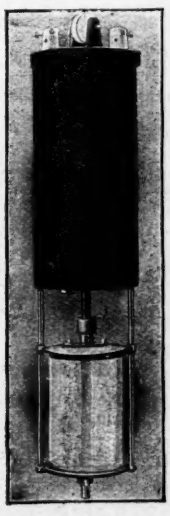


Photo-Printing Arc Lamp.

The "Veriflam" Lamp.

Messrs. Veritys' New Arc Lamps

In the firm's new list of "Aston" electric radiators (No. 624) many neat designs of luminous and non-luminous types are shown, prices and dimensions being stated beneath each illustration. An important departure consists in the use of an element which is composed of high-resistance wire insulated entirely on porcelain and supported on iron frames. These are made up in units, each having a consumption of 250 watts, and the units can be very easily replaced when necessary. A long life and excellent insulation are claimed. Among the designs shown are a series specially prepared

steel bars, making a rigid and fireproof construction, uninfluenced by climatic conditions, and of high insulation resistance. The British Admiralty specifies this construction for switchgear for use in dockyards and on board ship, and has purchased a large number of controllers on this principle from the Westinghouse Co.

LEGAL.

Workmen's Compensation Case.

We recently reported a Workmen's Compensation Act claim by Fred. Sharpe, electrician, Hackney, against the Shoreditch Borough Council, for compensation because of the effects of a severe electric shock received in the power house on December 23rd, 1908. When the case came on at the Shoreditch County Court on October 26th, Dr. Bate again sat with the Judge as Medical Referee, whilst there was a whole army of doctors present. Mr. Bryan appeared as counsel for the applicant, and Mr. Doughty, barrister, for the defendants—really the insurance company.

Mr. Doughty contended that the man's alleged inability was not due to physical incapacity, but was mental, if anything. He admitted there were difficulties in the case, as the man had had two very serious electrical shocks, which had left a bad case of nerves. He submitted that the man could do the work he was offered.

All the doctors then held a consultation with the man, and finally Dr. Bate said the man could and should do the work he was offered. There was no doubt that, to put the man to work in the electric power house would be something near approaching suicide for him, in fact, he would be a danger to other men there, but he should work, which would doubtless improve his nerves.

Mr. Doughty said that, since they left off the weekly payments, they had made disbursements, entirely without prejudice, of £23 9s. 8d., for the seaside convalescent home, pocket money, and sending him here, there and everywhere to get work. If they were liable, they would only have had to pay £25 4s., so, he contended, they had been very fair.

Judge Bray said he would not make any award, as that would retard the progress of an amicable settlement between the parties, but would adjourn the case, and he ordered the man to do whatever work he was offered, consistent with reason.

Remane *v.* Hastings Tramways Co.

This case has been already reported. His Honour Judge Scully gave judgment at Hastings last week.

His Honour accepted the applicant's medical adviser's opinion that the injury was caused by repeated flashing and flickering, but he did not think that entitled the applicant to compensation under the Act. The applicant had not established that the incapacity was caused by injury as defined by the Statute, and there would be judgment for the respondents, with costs. An application for leave to appeal was granted.

Paisley Tramways Arbitration.

At the resumption of this inquiry on Wednesday, October 26th, Mr. Talbot (for the Co.) continued his cross-examination of Mr. Parkinson. He pointed out to witness that in 1903-4 (before the tramways started) the expenditure on generating was £4,063, and in 1905, after 11 months of traction supply, the generating expenditure had increased to £5,316, or by 30 per cent., but the units consumed had increased from 1,220,430 in 1903-4, to 1,887,692, an increase of 85 per cent. He asked Witness if this did not bear out what Mr. Mordey had said with regard to the benefit that would accrue from the tramway load. Pressed on this point, Witness admitted that the increased consumption was chiefly due to the tramway load, but said this had not been so great an advantage to the electricity undertaking as was thought at the time.

Mr. Talbot put it to Witness that the increased works costs for the tramway load was £1,253 up to the end of 1905, and reckoning the capital expenditure at £20,000 charged at 10 per cent. on the consumption of 759,103 units in 1905, the cost per unit would only be ·7d. If they put the working expenses at £3,413 (a figure suggested by the Witness), and the capital expenditure at £40,000, charged at 10 per cent., the cost per unit would still only be 1·025d. —Witness agreed.

Re-examined by Mr Browne, Witness said the private power consumer who was charged 1·29d. per unit obtained this rate at a time when he was taking a big load. The 98 other power consumers were charged 1½d. per unit, which was higher than the charge to the company.

The Arbitrator said it was important to decide what the maximum load actually was, and Mr. Browne, said this would be mentioned by a subsequent witness. The Arbitrator said he had a statement before him showing the working cost of generating in 1904, the year before the tramways started, and in 1905 and 1906. This showed the excess costs of 1905 over 1904, and of 1906 over 1904, and it showed the extra units generated after the enlargement of the plant. The result was that in 1905 the average cost of the extra units was ·47d., and in 1906 ·44d. In 1905 the whole of the extra units were consumed by the tramway company, but in 1906 a portion might be attributed to power consumers. He asked witness, "Supposing I base the cost of production on ·47d. per unit, as the actual cost to you in 1905. Have you anything to say on that?"—Witness said he would rather not reply.

Witness, further questioned by the Arbitrator, said the cost would go down if they could increase their motor load, but there was not much chance of this.

The Arbitrator: What are the particular conditions at Paisley that prevent you from getting an increase like other towns?—I don't know; the price of the energy probably.

The Arbitrator: But it is stated that in Paisley you compare favourably with places all over the country. That being so, the immense advantage of a motor load should come to Paisley as well as other places.

Witness was questioned by the Arbitrator as to the statistics of management expenses. He had been into these figures, and he thought it would be found that the management expenses at Paisley were not below the average but on a par with similar towns, such as Ashton-under-Lyne, where the management expenses on a similar output were ·12d. per unit, as compared with ·13d. per unit at Paisley.

James Townley, engineer in charge at the Corporation electricity works at Paisley, said that a record taken on July 11th, 1908, showed the maximum load in one minute to be 1,450 amperes, or 832 kw., and the maximum load taken over three minutes 1,320 amperes. This return was taken at a busy time (Glasgow Fair Half-Holiday), and a record taken on a Saturday afternoon in the summer of 1909 gave the same load.

Mr. S. L. Pearce, city electrical engineer, Manchester, said he had made a special study of the system of charging for power for tramways when there was a "combined station" as at Paisley, and he had come to the opinion that the company were not entitled to any reduction of the terms on which they purchased energy for traction. The question depended on two matters, (1) the amount of plant and the consequent capital expenditure to be allocated to the tramways, (2) the load factor. The Paisley plant consisted of one 720-kw. steam generator, two 500-kw. steam generators, and a 200-kw. motor-generator for private power consumers. The records for the year 1909-10 showed the momentary maximum demand to be 845 kw., although this was exceeded on June last, when the maximum was 880 kw. The greatest momentary maximum demand at any time determined the plant that must be used. Witness believed that at one time the company contemplated putting on from 70 to 80 cars, and they were entitled to call for a supply of electricity for any number of cars. Under the penalty clause the Corporation were, therefore, wise in installing reserve plant.

Witness thought the allocation of capital charges made by the Corporation was fair.

The Arbitrator said he thought it would be fairer if the company were not charged as to the expenditure on lands and buildings for the floor space occupied by the plant that was converted from lighting to traction plant, and took up twice as much room as new machinery would have done.

Witness went on to explain in detail how the total charges to the tramway were made. On the capital expenditure of £48,474 for traction plant, the interest on loans at 3·05 per cent. came to £1,478, and three items for depreciation, making a total of £2,850. Then there were the standing charges, amounting to £2,714 in all. The proportion of this charged to the company was £1,406 13s., and was arrived at by taking the mean maximum demand for winter and summer by the company, which gave 680 kw. This maximum was arrived at by taking a load sustained from 3 to 5 min. The maximum demand for all electricity generated was 1,312 kw., and he arrived at the figures given by dividing £2,714 by 680 over 1,312. The running charges were: Coal, £2,471; oil and waste, £158; repairs, £351; wages, £1,084; giving a total of £4,064. The total units generated were 2,076,762, of which the tramways took 1,236,822, and their portion of the running expenses was, therefore, £1,914. The total rent, rates and taxes were £2,115, of which the company were charged £884. The total charge to the company for capital account, standing and running charges, and rent, rates and taxes was £7,055 18s. 6d., which meant a rate of 1·369d. per unit to cover the actual cost. Witness went on to say that the load factor at Paisley was poor, and this militated against low costs.

Cross-examined by Mr. Talbot, Witness believed that 1,720 kw. was necessary for the Paisley tram load. He could not give any parallel instance of a place where so much plant was used in proportion to the load required. He estimated that the costs of distribution in Paisley would mean another 25 per cent.

On Friday, Mr. W. M. Mordey, the consulting engineer to the Paisley Corporation, was called, and occupied the witness chair all day. He expressed the opinion that the Tramway Co. were not entitled to any reduction, as their load factor was very low. He produced statistics showing that the price of energy for tramways in nine towns, comparable with Paisley, was on an average 1·37d. He had originally advised the Corporation to install three 300-kw. machines, but knowing the circumstances he would now advise three 450-kw. machines and one spare, because although the tramways only used 1·3 units per car-mile, the maximum demand was enormous. Further questioned, Witness said he would allocate five-ninths of the total expenditure at the generating station since 1905 to the tramways. When Witness's firm estimated originally, they did not anticipate such a large maximum demand. The maximum load was 50 per cent. larger than they anticipated. Witness

would now recommend three 450-kw. machines and a spare one of the same power, bringing the total kilowatts up to 1,800, as against the 1,720 now available.

The Arbitrator asked if, in fixing a price, he could take it that the costs of production would be reduced by an increased motor load for private consumers.—Witness said he thought not. Paisley was in a position that while there were two or three big industries carried on, these were so large that it paid the owners to install their own plant, and if these people did not take a supply, Paisley was in the position of a small town.

The Arbitrator then asked witness why he should not base the charge to be made to the tramway company on the actual works cost for the increased units required for the undertaking in 1905, namely, ·47d. He could take this as a basis, and would then have to consider what part of the capital charge of £48,000 would have to be added.—Witness said he did not think this would be fair to the Corporation, as a consumer ought to be charged a proportion of all the expenses of generating. He explained that supposing the generating station had been built, and run merely for the tramway load, the cost per unit would have been very much higher than it was, and the price should be arranged on this basis.

Mr. Browne then addressed the Arbitrator on the whole case, and pointed out that beyond the cross-examination of the Corporation's witnesses, the company had called no evidence to show what the cost of the undertaking had been. The actual excess cost for producing the tramway load in 1905 was ·47d., but if they added the capital cost, ·55d., they got 1·02d. per unit. This was not all, because there were the rates and taxes, which amounted to £2,635, and brought the cost up to 1·185d. This figure would not do, because they had to add to it a proportion of standing charges, based on the whole consumption of units for every purpose. This brought the price per unit up to 1·309d., without allowing any profit to the Corporation, and surely they were entitled to a profit.

Mr. Talbot briefly replied for the company, pointing out that the Corporation supplied small consumers at 1·19d., and reckoned to do it at a profit, but they charged the company 1·43d.—The inquiry then terminated.

Gas Companies and Municipal Electric Wiring.—Last week the Gas Companies' Protection Association had before it, at its annual meeting, held at Westminster, the proposed legislation of municipal authorities as to electric wiring. According to the *Gas World's* report, "Mr. R. Hall, of Matlock, speaking on behalf of the Federated Association of Ironmongers (Incorporated), said that last year a Bill was promoted by the Incorporated Municipal Electrical Association for the purpose of enabling corporations to provide wiring and also to sell electricity goods at such prices as they might think fit. That was regarded by the members of his Association as very prejudicial to them, because many of them were interested in the electrical industry, and regularly employed in the work of electric wiring, &c. The Association and the Electrical Contractors' Association opposed the clause successfully. It was a matter of some concern to them that a clause that was intended really and mainly as an attack on the gas industry was not opposed by the Gas Companies' Protection Association or any gas association. He understood that the Municipal Electrical Association were again promoting something on the same lines, and 60 corporations were supporting the proposal, and the fight was likely to be more severe than before. The electric people were feeling more strongly on the question than before on account of the Leicester decision, that unless a corporation had special powers under their Act, they could not provide electric fittings. He came to that meeting, with a good deal of confidence, to ask that, if similar proposals were brought forward in the coming session, they would take their part in opposing them. Surely it was the business of an association that was for the protection of the gas industry to go into the forefront of the battle and defeat what had been defeated before. As to the exact form the proposals would take he could not say, but there was no doubt whatever as to what was intended. His Association could hardly undertake to fight it again single-handed, and they felt that the burden ought to be shared by the gas interests.

"The Chairman (Mr. H. E. Jones) said that Parliament had shown a great disinclination to give them a *locus standi* in the matter, for they would be opposing the electrical bodies in doing that which they were doing themselves. The committee had discussed the matter that day, and they were prepared to take into consideration the whole question, and to take action in some shape or other. They saw how electric undertakings, when they had a deficit, made it good out of the rates, and gas companies as large ratepayers suffered.

"Alderman Hart said he had much experience of the way electric undertakings bolstered up their accounts, and he thought the matter should be carefully watched.

"Mr. Hall said there was another matter which he would like to bring forward. It was most desirable that gas companies should more generally enter into arrangements with ironmongers.

"The Chairman replied that that was outside the scope of the Association. The ironmongers had brought the trouble on themselves. Had they looked ahead, there would have been no trouble. The gas companies had not wanted to undertake fitting work, but the ironmongers were not prepared to do it, and it had to be done."

PROCEEDINGS OF INSTITUTIONS.

Large Gas Engines and their Troubles.

By Frank Foster, M.Sc.

(*Abstract of Paper read at the* Manchester Engineering Exhibition, *October 24th*, 1910.

The purpose of this paper is primarily to discuss the difficulties which have to be overcome by the makers of large gas engines.

A great many different engine constructions can be obtained by varying the arrangement of the cylinders, and the designer has often some difficulty in choosing an arrangement in view of the frequently-conflicting considerations of cheapness, floor space, accessibility, turning quality and fashion.

The double-acting four-cycle horizontal engine might almost claim to be the world's standard for large powers.

Single-acting vertical four-cycle engines have been built in sizes up to 1,000 b.h.p., having four cranks and eight cylinders.

Single-acting and double-acting two-cycle horizontal engines are also made in this country.

Hydro-gas engines are represented by the Humphrey pump. This stores water in a tank or under pressure; if mechanical power is desired it must pass through a hydraulic turbine, so that for most purposes one unit consists of a hydro-gas pump and a water turbine.

The difficulties to be met may be constructive, operative, or commercial. All three are to some extent related, and the first two particularly so.

Dealing with the purely engineering difficulties first, there are certain fundamental considerations to be kept in mind. It is known that temperatures between 2,000° and 3,000° F. are regularly attained in gas engine cylinders. Now, the mean temperature of the inside face of the metal increases with the mean temperature of the gases and the vigour of their scouring action, with the diameter of the cylinder and the thickness of the cylinder, or other, walls; but decreases with a decrease in the jacket-water temperature, and an increase in the conductivity of the metal. Neither of these last two qualities can be materially controlled by the designer, although it is important not to work with the jacket-water too hot.

There are several ways of influencing the mean temperature of the gases: scavenging, that is, washing out the cylinder between explosions with cold air, if properly applied and with a properly designed combustion chamber and valve parts, gives good results at some little cost in power. If unskilfully applied it may increase the chances of cylinder troubles by increasing the temperature differences between adjacent parts and by increasing the range of temperature fluctuation.

A four-cycle cylinder, having only half as many explosions as a two-cycle cylinder at the same speed of revolution, has obviously a much lower temperature than the latter. Again, the mean gas temperature may be reduced by using a weak charge and by keeping down the maximum pressure and temperature attained on explosion. These devices are, in fact, adopted in all large gas engines, the maximum pressure—and with it also the maximum temperature—being reduced by keeping the compression low. Present values are distinctly lower than was the case a few years ago, whilst the mean effective pressure—which is determined partly by the strength of the charge and partly by the value of the compression—is not allowed greatly to exceed 70 lb. per sq. in. This value should not be maintained for more than a few minutes at a time—less if the engine is internally dirty—and is considerably reduced for continuous running.

The diameter of the cylinder affects the temperature of the gases in the following way. The gases near the walls are colder than those in the body of the combustion chamber, because of the cooling action of the cylinder walls. This cooling action obviously decreases as the ratio of the wall surface to gas volume decreases, and therefore is less marked in a large than a small cylinder. It partly accounts for the fact that in engines of similar design very few cylinder troubles were experienced with engines developing about 250 b.h.p. per cylinder, whilst most serious troubles were met with when from twice to four times this power was developed per cylinder.

The two-cycle engine has only a slightly higher maximum temperature than a four-cycle engine. In some respects the maximum temperature is of more importance than the mean. Many of the cracks in gas engine cylinders are caused by surface heat stresses. Thus, if the mean temperature of the wall surface is 500° F., the actual value may fluctuate between, possibly, 300° and 1,000°, and the surface layer will tend to contract and expand correspondingly. The body of the metal prevents this contraction and expansion, so that tensile and compressive stresses are set up in addition to the stresses arising from gas pressure, casting strains, or unequal distribution of temperature between the various parts of the cylinder. The compressive stresses produced by resisting the expansion would be about 19 tons per sq. in. for cast-iron and 43 tons per sq. in. for steel. It will be seen that steel, by reason of its high modulus of elasticity, is more highly stressed than cast-iron and may give inferior results, as in fact frequently happens where heat stresses are very important. It should be noted that excessive surface-cooling, such as is produced in badly-designed cylinders, with scavenging sets up serious tensile stresses, which are very dangerous with cast-iron. Local surface failure of the metal may easily occur. Once failure has taken place the tensile stresses due to gas pressure enlarge the crack by tearing, so that the ultimate failure may be due to mechanical rather than thermal causes.

The general defects encountered in gas-engine cylinders are all directly or indirectly due to heat. A cylinder cast in one piece has two primary defects. In the first place, the parts are too rigidly tied together to permit of the casting contracting freely in the mould when cooling. Hence such cylinders are never obtained without initial casting stresses of unknown amount. In the second place, when the cylinder is working, the outer barrel is normally cooled by the jacket water and the air, so that it practically does not expand. The inner or working barrel, on the other hand, becomes hot by contact with the gases and expands. The expansion of the inner barrel is resisted by the cold outer barrel. These two barrels pulling in opposition put the outer one into tension and the inner into compression, and tend to break off the neck pieces at the junctions with the barrels. In practice cracks are commonly started at these junctions, and after a time, in spite of ductile straps of metal riveted across the crack, the cylinder has to be renewed. In some designs this weakness is increased by omitting to bellmouth the necks at the junctions, such omission not only leading to mechanical weakness, but also, by reason of the scour against the sharp corner of metal at the junction, leading to excessive heat stresses.

Balancing the casting stresses against the expansion stresses seems highly scientific and satisfactory, but looked at more closely it bristles with difficulties. On this method one has to balance one unknown and variable stress by another unknown and variable stress.

In the Ehrhardt and Sehmer engine, as made by Messrs. Galloways, of Manchester, the casting stresses are reduced to a minimum by adopting a built-up construction. The cylinder body is split transversely and is cast in two symmetrical halves. Each approximates to a double cylinder with a cross-section of flat U-shape, which permits very free contraction in the mould, and casting stresses are reduced to a minimum. In its completed form the outer barrel or jacket-casing is a rolled steel band in halves clipped into the cylinder body through rubber joint rings. These rings form an expansion joint, so that the inner barrel is free to expand, and in practice a movement of as much as 2 mm. takes place. It is important that the jacket casing should not be bolted rigidly to the cylinder body or ends. Evidence of the success of this method of attacking the problem is to be found in the number of makers who are trying built-up designs. One of the incidental advantages of a cylinder of this type is that should one cylinder-end crack, it is not necessary to replace the whole cylinder, but only the defective half. The liner is held between the two cylinder ends by a collar, and cannot work loose. This liner has two functions. It is intended to act as a wearing liner, which can be bored out when necessary, and finally renewed without replacing the cylinder body; it also acts as a heat shield to the cylinder barrel.

Next to the cylinder, the piston has probably caused more trouble than any other gas-engine part. In the case of double-acting engines it is absolutely necessary to water-cool the piston, and in the case of single-acting engines it is desirable to do so in the larger sizes. A hot piston heats up the incoming charge, and reduces the weight of the charge taken in per stroke, and therefore also the maximum power which the engine will develop. Also, if there are any projections on the piston face, these may become so hot as to cause pre-ignition of the charge, which are apt to be dangerous as well as objectionable. Further, the high temperature affects the metal and promotes cracks. Even more objectionable is the fact that in order to allow for the expansion of the piston it is made a very slack fit in the cylinder. Before it has fully warmed up, it is liable to allow the hot gases to blow past it, and these very soon score the cylinder walls and establish a permanent leakiness, which is bad for the engine, and renders the atmosphere of the engine room bad for men and electrical machinery.

Water-cooled pistons have had their troubles. As in the case of cylinders, casting stresses are found in the piston, the boss or centre being in tension. When working, the outer circumference is always hotter than the boss, and its expansion tends to increase the tensile stresses in the boss. In Messrs. Ehrhardt & Sehmer's design the nut grips the piston so that the whole boss is in compression. Also, conical shoulders on the nut and rod between which the piston is held enable sharp curves in the "flow" of the metal of the boss to be avoided. The outer circumference is narrower than the boss, and therefore its expansion affects the boss proportionately less than in the old piston. In practice this design has proved wholly satisfactory.

Some makers have endeavoured to overcome their piston troubles by adopting a built-up construction, the piston halves being bolted to a shoulder on the rod. This method enables casting stresses to be eliminated, but does not avoid expansion stresses. The cases of cylinder and piston, it must be remembered, are not strictly analogous. In the piston it is not possible to take up expansion by an expansion-joint design, and hence one great advantage of the built-up design cannot be utilised. Mention should be made of the troubles due to imperfect internal ribbing, arising mainly from spongy metal. This sponginess can be overcome by careful design, but many makers prefer to avoid ribs altogether and, instead, make their pistons very deep for strength.

The average Continental designer has allowed his love of scientific detail and geometrical accuracy to run riot when designing valve gears. According to the reports of Mr. Michael Longridge, about one-third of the gas-engine breakdowns coming under his observation arise out of defective valve gears. Hence the importance of simplifying these gears.

There is one other serious trouble which all makers of large gas engines have to face. Gas engines are more expensive than steam. Under very favourable conditions the difference in cost between a gas plant and a steam plant may be reduced to a small amount—perhaps 5 or 10 per cent.; but five times this is more usual. Unfortunately some enthusiasts have used the exceptionally favourable instances to demonstrate that gas plants really do not cost much more than steam, with the result that customers imagine they are being bled when they purchase a gas plant, and prices have been forced down to an unremunerative level. The gas engine is a great saver of fuel, and customers ought to be only too pleased to pay the extra cost of one.

The Self-Propelled Vehicle.

In the course of his presidential address to the Incorporated Institution of Automobile Engineers, on October 12th, Mr. F. W. Lanchester discussed various factors which have contributed to the advance of automobile engineering, and control the development of the self-propelled vehicle. Foremost amongst these he placed the question of road-building, which he regarded almost as the question of the hour. The fact that a large number of materials and mechanical devices, unknown 60, or even 30, years ago, become available almost simultaneously—such as pneumatic tires, ball bearings, machine tools of precision, the petrol motor, and petroleum spirit—was a remarkable one, and had a most important bearing on the development of the motor-car. The pleasure-car was free from external competition, owing to the overwhelming advantages of motor propulsion, including that of economy in running cost. In the case of commercial vehicles the position was different; it was only in certain cases that motors could be substituted for horse traction with advantage. Their future largely depended upon the cost of materials, especially fuel. This had now been made the subject of taxation, but heavier petroleum could be substituted for petrol with considerable economy on motor lorries, &c. The best results hitherto obtained by the commercial vehicle were about 60 ton-miles per gallon of spirit. The motor-omnibus (fully loaded) could do from 40 to 50 ton-miles per gallon. The future of the commercial vehicle depended upon the saving of money in first cost and upkeep, and this, again, turned largely upon the condition of the roads. Uniformity in the character of the road surface was extremely important; if a vehicle had to be capable of travelling on bad roads, it could not take full advantage of a good road when the opportunity arose.

The petrol motor-car was, to a great extent, standardised; the change-gear box was the weakest point in the chain of mechanism—it was notoriously a makeshift appliance, and its survival was mainly due to the fact that the direct drive was in operation most of the time. The key to the evolution of a new and improved system was the gear box. The epicyclic gear was superior to the sliding gear, but costly to make. Other alternatives were hydraulic and electrical transmission and electrical auxiliary. The first two might be substituted for the gear box, or might be made to operate the road wheels direct, doing away with the right angle drive and, perhaps, the differential. The best result obtainable with hydraulic transmission was an efficiency of 70 per cent., about 20 per cent. inferior to the direct drive and 10 per cent. inferior to gearing. Owing to considerations of weight, the high efficiencies of stationary electrical machines could not be obtained on vehicles, and the electrical transmission therefore was not likely to come into use.

The "electrical auxiliary," however, opened up a new field of possibility. In this system, a shunt dynamo was mounted on the engine bed-plate, direct coupled to the engine. This drove through a magnetic clutch on to the differential, or might be fitted in duplicate to drive through duplicate gearing direct on to the road wheels. A storage battery was provided, usually of about 5 per cent. of the total weight of the vehicle, which took up excess power when going down hill or on a level, and gave up the energy so stored when required to ascend a gradient. The alternative function of the dynamo was determined automatically by the speed variation; when the petrol engine was slowed down by excessive resistance, the armature voltage fell and the battery began to assist to drive the vehicle; when, on the contrary, the engine attempted to race, the voltage rose as a consequence, and current flowed in the opposite direction and charged the battery. Thus an approximately uniform speed was maintained, the vehicle taking but little notice of the ups and downs encountered. Likewise, when stopping, part of the energy was thrown into the battery, and was drawn out again when getting under way.

The future of the petrol-electric auxiliary system must rest largely with the question of accumulator weight, not the weight per H.P.-hour, that is the energy content, but rather the H.P. output, *i.e.*, the *rate of doing work*. At present, the best result commercially attainable for brief discharges of but a few minutes' duration was the equivalent of 1 H.P. per 40 lb. weight. This was reasonably satisfactory for vehicles of moderate speed—less than 20 M.P.H.—but not good enough for the pleasure vehicle. If the battery weight could be reduced to 20 lb. per H.P., the proposition would be worthy of serious consideration.

Electrical Progress in the United States.

On Friday last, at the first meeting of the session of the Institution of Electrical Engineers (Manchester Section), the chairman, Mr. J. S. Peck, delivered his inaugural address. He remarked that, with a single exception, he was the only American to occupy the position of chairman of even a local section of the I.E.E.

His predecessor in office had covered in a very thorough manner the progress which electrical engineering had made in this country; as he had recently returned from a trip to America, it had occurred to him that a description of the progress made there in certain lines

of electrical work might be of interest to them, as indicating certain differences in the engineering practices of the two countries.

The engineering features which impressed him most were the enormous quantities of standard machines which were being manufactured, and the great advances made in electric traction.

The large motors for the enormous electric locomotives, now being used by many of the main steam roads for drawing trains in and out of their terminal stations, and for hauling trains through tunnels, resembled low-speed engine-type generators more than tramway motors, and it was difficult to realise that a 14-pole machine, with an armature 6 ft. in diameter, was really a railway motor. The general plan on these locomotives was to place the motor above the axles, so that the centre of gravity was considerably higher than with the older types of electric locomotives. The motor usually projected above the floor of the locomotive, near the centre line, so that there was room to pass all round it, inside the cab. The control apparatus, which was always of the multiple unit type, was also located inside the cab on the centre line, with a passage-way on either side of it. This gave the maximum amount of accessibility. In some cases the motor drove through gears, but more often through cranks and jack shafts. The wheels were coupled by side rods.

The largest systems in operation were the New York Central, and the New York, Newhaven and Hartford Railways. The former was entirely direct current, while the latter—intended primarily for single-phase—also operated over the direct-current system of the New York Central. Both systems seemed to be entirely satisfactory. The Newhaven road was about to be extended to Newhaven, some 65 miles, which was probably the first step toward the complete electrification of the system between New York and Boston, a distance of 250 miles.

The electrification of the Pennsylvania system into New York City was well under way. This was on the direct-current system, and the locomotives were the most powerful yet built.

For tramway and light railway motors the commutating pole was regarded as highly desirable, and motors of this type appeared to be as nearly perfect as it was possible to build any electrical apparatus. The tendency in most of the large cities of America seemed to be to increase the size of tramcars and to increase their driving power.

Several plants were operating successfully at 110,000 volts, and 200,000 volts appeared much nearer than did 100,000 ten years ago. The higher the voltage, the less was the trouble experienced from lightning on transforming apparatus, but, on the other hand, the greater the trouble on the transmission line itself, due to broken insulators. On the Ontario Power Co.'s circuits, the trouble due to the breaking of line insulators had been greatly reduced by placing an earthed metal ring round each insulator, the arc being transferred from the metal pin supporting the insulator to this ring, thus preventing the breaking of the petticoats of the insulator.

Apparently the most satisfactory method yet proposed for protecting the line was the use of the overhead ground wire, though lightning rods on each pole or tower, metal rings round the pin, &c., were being tried. The electrolytic lightning arrester was being almost universally adopted, and it was recently stated at a meeting of the A.I.E.E. that the problem of lightning protection for station apparatus had been completely solved, and that the work of the so-called lightning arrester expert was now to devise methods of protecting the line itself.

Steel towers with long spans were being used extensively. Originally the towers were made of very rigid construction, but the practice now appeared to be to make the towers more flexible in the direction of the line, but very stiff against lateral strains. With this construction, in the case of line breakage, the towers were deflected, and the strain was divided among several of them. This permitted of a lighter and cheaper construction of tower.

In turbo-machinery the tendency was towards higher and higher speeds. For 25-period work, 1,500 R.P.M. was the minimum speed for all machines, regardless of size, while for 60 periods 3,600 R.P.M. was used up to about 2,500 KW., and 1,800 R.P.M. from 3,000 to 15,000 KW. Peripheral speeds of field magnets ran up to 23,000 ft. per minute. The general practice was to build machines with poor regulation, and to supply automatic regulators for maintaining constant voltage.

With reference to D.C. turbos, much greater progress had been made in Great Britain than in America. One of the large manufacturing companies was advocating for direct current work a high-speed A.C. turbo with 60-period rotary converter. The A.C. end of the rotary could be connected direct to the generator, so that it started and stopped with the generator, and no synchronising apparatus or transformers were required. It was claimed that the electrical portion of this combination was approximately as efficient as a D.C. generator, while the very high speed of the turbo set (3,600 R.P.M.), gave a cheap and economical turbine, so that the cost of the whole outfit as well as its steam consumption was less than for a D.C. turbo set.

He saw a number of single-phase shell-type transformers of 1,000 KW. capacity, wound for 110,000 volts, placed in boiler plate tanks of the self-cooling type. The necessary radiating surface was obtained by means of steel tubes welded into the case, connecting the oil in the top with that in the bottom. The tubes were, of course, external to the case, and presented a large radiating surface.

It was becoming the practice to ship the transformer, case and oil complete. This eliminated drying out and filling with oil on site.

An enormous business was being done in transformers for house-to-house lighting, in sizes from ½ to 100 KW. These transformers were absolutely standard, and on account of the enormous numbers manufactured, the makers were able to turn out an extremely efficient piece of apparatus at a very low cost.

The manufacturing companies had been devoting a great deal of time and money to increasing the demand for electric motors. For years past they had been collecting information regarding the power required, cost of operating, &c., for all kinds of different work; and this information placed in the hands of the so-called industrial expert enabled him to talk intelligently, and to push the use of motors for various classes of work.

In connection with small motors, the expert from the manufacturing company worked in close conjunction with the supply company. The expert would usually open the campaign in a certain city, coach the engineers of the supply company as to the most approved methods of obtaining business, and then leave it for the supply company to carry on. As a consideration for the help rendered by the manufacturer, the supply company would usually push the sale of the particular manufacturer's goods, or give him some preference in the business. Sewing machines, vacuum cleaners, phonographs, washing machines, coffee grinders, candy mixers, and numbers of other machines were driven by small motors. There was also an enormous demand for fan motors of various kinds. One plant which he visited had been turning out fan motors at the rate of over 6,000 per month for the past year, yet by the middle of July their entire stock was exhausted.

In one plant which he visited, they were turning out 1,000 A.C. watt-hour meters per day. The output had been increasing steadily for some years, and it was predicted that in another year 1,200 to 1,500 per day would be the output. These meters were beautifully made, and contained various adjustments and refinements not found on European meters; yet on account of the enormous output, they were able to manufacture for much less than the same instrument could be made for in this country, in spite of the fact that the price of labour there was more than twice as high as in England. This enormous output in wattmeters as manufactured by one company gave some idea as to the rate at which the industry was advancing in America.

The great majority of the arc lamps in use in America were of the enclosed type, but the flaming arc was coming into more general use. For street lighting, the lamps were usually run in series from a constant-current generator, or a constant-current transformer. The latter system was in very general use. Where a direct-current series system was required, a constant-current transformer was used in connection with a mercury vapour converter.

Another lamp which seemed to offer great promise, and which was already used to some considerable extent, was the magnetite or metallic-flame lamp. In this lamp the positive electrode was of copper and iron, and the negative of iron and titanium oxide, with chromium and other oxides. A pair of electrodes costing 5d. would burn from 200 to 260 hours. The light was white in colour, and the distribution very good, so that lamps might be placed 10 per cent. or 15 per cent. further apart than enclosed lamps, and still give better illumination. A current of 4 amperes was ordinarily used, with 75 volts across each lamp. Thus the energy consumption was about one-half that of the standard enclosed lamp. The lamp was suitable for outdoor work only, since heavy fumes were given off from the negative electrode; a special system of ventilation was arranged for carrying off these fumes.

While the greater part of the large electrical machinery work, and practically all the electrical railway work, was done by either the General Electric or Westinghouse Companies, there was the keenest engineering competition between them. The prosperous condition of the large companies enabled them to carry large engineering staffs to support research and experimental laboratories, and to undertake the development of new lines of apparatus and of new electrical systems, on a scale quite impossible for the manufacturers of this country. A recent annual report of one of the large companies showed that they had expended over £50,000 in experimental and development work in a single year.

From what had been said it would be gathered that the electrical business in America was in a flourishing condition, while all British manufacturers deplored the condition of business in this country. The question which naturally arose, was to what this difference was due. He proposed to discuss very briefly a few of the factors which influenced the electrical manufacturing business, and to point out some of the differences between the two countries.

America was a new and rapidly-growing country. Manufacturers believed that the scrap-heap was the place for obsolete machinery. The business men were daring, and were prepared to take a certain amount of risk in trying a new thing. A little less conservatism on the part of the directors of British companies in adopting electric machinery would often result to the mutual advantage of their shareholders and the electrical manufacturers.

There was no doubt that Great Britain was far behind both Germany and America in the extent to which technical education was adopted. By technical education he meant the higher theoretical training obtained at colleges and universities.

The rate at which other nations that had adopted technical education were overhauling Great Britain had forced from our manufacturers an admission that technical education was a thing to be desired for an engineer.

The college man of America had made good; he had shown that he was not afraid of hard and dirty work, and he had demonstrated beyond question that the training received at college enabled him to outstrip the man of equal natural ability who had not had this training.

To-day the manufacturing companies were competing for men before they left college, and it was not unusual for practically the whole graduating class in some of the colleges to have positions secured before graduation day, and with salary enough guaranteed at least to pay living expenses. He saw an advertisement in one of the American college papers, stating that a telephone company were prepared to take a certain number of college men on a six

months' apprenticeship course, at a salary of £12 per month. If at the end of six months they were satisfactory, they would be taken on the staff at salaries depending upon the positions obtained.

The American Westinghouse Co. paid its college apprentices 9d. per hour: the Westinghouse Machine Co. slightly more than this, and these examples were fairly representative.

The manufacturing companies also attempted to foster a spirit of loyalty in the young college men who passed through their works, as these men were of great help to them in securing business when they had taken up positions with operating companies, perhaps in foreign countries. German companies also appreciated the value to them of the graduates from their works.

In the works of almost any large British manufacturing company, they would find many of the best positions in the engineering departments filled by foreign engineers. Why? Certainly not because British manufacturers preferred foreigners, but because British educated engineers with the requisite training were not available.

The electrical manufacturer of America had never been seriously hampered by those restrictions which labour organisations attempted to impose upon manufacturers here, and if Great Britain was to improve or even maintain her position as a manufacturing nation, she must demand the same freedom as her competitors in dealing with this problem.

Municipal control of electric supply and tramways was never seriously undertaken in American cities. Undoubtedly the people had been imposed upon with overcrowded tramcars, high prices for electric light, &c., but development had gone on apace, and the electrical manufacturers, as well as the supply and traction companies, had prospered. To-day the tendency seemed to be to leave this work in the hands of the companies, but to put limitations upon them, allowing them to make fair profits, but insisting on good service and reasonable charges.

The policy of the municipal undertakings in Great Britain in accepting the lowest tender was in part responsible for the cut-throat prices which ruled to-day. This practice of awarding to the lowest bidder was carried so far that business was often given to foreign competitors, and though comparatively little work went abroad at the present time, it was probably due more to the fact that ruling British prices offered little inducement to the foreigners, than to any spirit of patriotism on the part of the municipalities. But the ever-present fear of foreign competition kept prices at an unremunerative level.

In America there had been an enormous development in inter-urban railway lines—a field scarcely touched in Great Britain, due to the expense of getting Bills through Parliament, the jealousy of town councils, and the opposition of wealthy property-holders along the proposed lines. Yet there was no doubt that high-speed electric railways through many parts of this country would be of great benefit to the sections served by them, and would prove great financial successes, provided excessive charges were not entailed in getting powers to build and operate. In other lines of work also the American companies had great freedom in following out their own methods of working. The rapid development of America would never have come about had the same restrictions as to high voltage, overhead lines, negative rail drop, &c., being imposed there as existed here.

The large electrical manufacturing companies in America employed specialists in all departments of engineering, and it was generally admitted that these men knew more about their particular lines of work than the consulting engineer could be expected to know. Thus the consultant in his specification told what he wished to accomplish, and asked the manufacturers to say how they could best obtain the desired results, and what guarantees they were prepared to make. When the manufacturers had submitted their plans, the most suitable one was selected by the engineer, and the details finally settled between the consulting engineer and the engineers of the manufacturers. This method of procedure enabled the manufacturers to put forward their standard apparatus, and so to supply a better and cheaper plant than if the consulting engineer called for all manner of special apparatus.

In England the practice had been for the consulting engineer to specify in great detail particulars regarding all the work to be done by the manufacturer. But it was now becoming generally recognised by the more progressive consulting engineers that each manufacturer should be allowed great latitude in the design of his apparatus, as long as the specified results were secured.

In America the demand for labour is usually greater than the supply, and the rate of wage at least double that in this country. This condition naturally created a great difference in the demand for labour-saving machines, and was in part responsible for the enormous demand for small electric appliances.

Labour-saving devices could and would be used with advantage in this country to a far greater extent than at present, but the low cost and plentiful supply of labour did not make their introduction so imperative as in America.

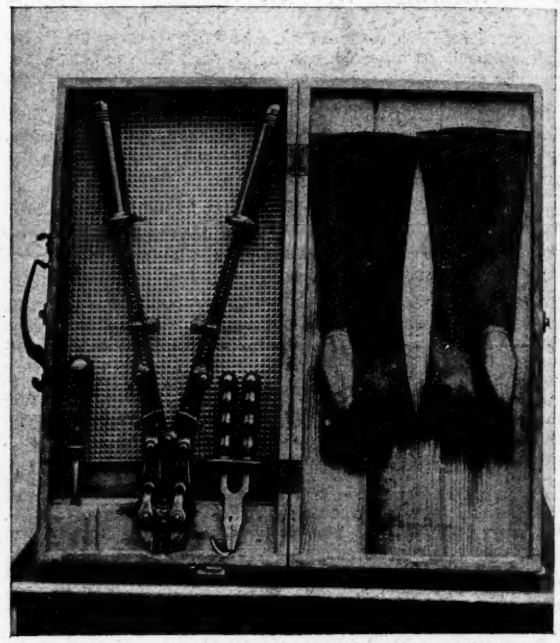
A very large market for electrical apparatus had been created in America by the utilisation of water powers. This was a practically non-existent market in Great Britain, though work of the same nature was done by our large power supply companies.

Regardless of whether a tariff would help Great Britain or not, there was no doubt that it had greatly helped the American electrical manufacturer, for, with an enormous home market, he had pushed ahead with its development with the assurance that it was reserved for him, and that no foreign competitor could take it from him. So large was this home market, that its demands had filled his works with orders at remunerative prices, and left little inducement for him to compete for foreign business. The tariff wall was naturally responsible for higher prices in America, but low prices and prosperity were not synonymous terms.

FIRE PREVENTION IN GERMANY.

We recently received from the British Fire Prevention Committee a copy of the "Record" drawn up by a Special Commission, appointed by the Committee last year to investigate the provision made in Berlin, Hamburg and Hanover for the prevention of fire. The Record is very complete and fully illustrated, and contains much valuable information relating to the latest practice in Northern Germany. Incidentally, the Commission was struck with the total absence of slums and loafers in the towns visited, the healthy and well-nourished appearance of the children, and the smartness of the workmen, which is ascribed to the benefits derived from their military training; there is, says the Commission, no unemployed class to be provided for.

It is noteworthy that electrical appliances are on the increase in Germany; a 90-ft. mechanical ladder, a motor "trap," and a motor chemical engine are illustrated, all of



Fireman's Equipment for Dealing with High-Pressure Conductors.

which are electromobiles. These are in use at Hanover, where it is intended ultimately to make all the equipment self-propelled. A special telegraph inspector is attached to the Brigade. Particulars are given of the cost of upkeep and running of the electromobiles for three years, showing an average annual total of about £34 each, as compared with about £200 for horsed vehicles. The automobile appliances were stronger and more efficient than the horsed appliances which they replaced, and the saving effected by their use is estimated to repay their capital cost in five years, while their useful life is estimated at 15 years.

At Berlin also, the horsed appliances are being superseded by electromobiles, of which 16 have recently been acquired. Each fire station is to have four electromobiles, namely, a chemical engine, a "trap," a steam fire engine, and a mechanically-raised 85-ft. ladder. The motors, coupled to the front wheels, are of 7·5 H.P. each, and are supplied with energy by 18 storage cells in three trays, each cell weighing 10 kg. The effective range of the vehicles is 60 km., at 30 km. per hour. In the case of the ladder, an electric motor is employed to bring it to the "ready" position, after which it is "shot up" to its full height in 20 seconds by compressed carbon dioxide, the whole operation taking 36 seconds. The weight of the respective vehicles varies between 5,053 and 5,780 kg., with crews, and the cost between £1,250 and £1,800 each. In addition to the four sets (16 appliances) already in service, 16 sets (64 appliances) are on order, the total cost of each set being £6,150. Besides the greater efficiency and longer range of the

electromobiles, a saving of £8,000 per annum in upkeep and other expenses is anticipated on the 20 sets as compared with horsed sets. We understand that the vehicles above-mentioned are of the Austrian Daimler Co.'s make.

Thirty foremen and 250 men of the Berlin Royal Police Fire Brigade have been specially instructed at the Berlin Electricity Works in the handling of electromobiles, and in dealing with electrical risks due to high pressure, &c. The course of instruction occupies four full weeks. The foremen have also been instructed at the tramway depôt in handling electric tramcars, including breakdown work, on account of difficulties which have been experienced due to cars stopping or being derailed near the scene of a fire. The men are provided with a special set of tools for dealing with high-pressure cables, of which we reproduce an illustration from the report.

At Hamburg also, a number of electromobile appliances are in use and on order.

The Record of the Commission makes it clear that in dealing with fire the German authorities are years in advance of our own, and that they have abundantly satisfied themselves of the many advantages offered by the electromobile for this service. Fortunately, as we have mentioned before, steps are being taken by the London Fire Brigade towards the adoption of electrically-propelled vehicles, of which one, we believe, is in use and three are on order. A perusal of this Record, with its numerous illustrations and technical details, will be found most interesting, and we trust that it will be read, and its lessons taken to heart, by everyone engaged in the prevention or extinction of fire, the construction of fire-proof buildings, and the manufacture of electromobiles and fire appliances.

THE LESS IMPORTANT GERMAN FIRMS.

The recent transactions in the German electrical engineering industry have induced a correspondent of a Frankfort newspaper to endeavour to dispel the impression which has been created in the minds of the public in that country, but not in Great Britain, that the whole of the trade is dominated by three or four large firms. He points out that in addition to the latter there is quite a number of extremely competent works of a special character which, in contradistinction to the large firms which mainly combine manufacturing and contracting works, are solely occupied with the production of individual articles, or of only a few groups of them. As instances are mentioned, the construction of dynamos, switch apparatus, measuring instruments, cables, bare and insulated conductors, insulating materials, transformers, electricity meters, glow lamp sockets, switchboards, safety appliances, arc lamps, carbons, glow lamps, heating and cooking apparatus, &c. These speciality works are distributed all over the country in Berlin, Frankfort-on-Main, Munich, Rhenish-Westphalia, and Thuringia, and in the Kingdoms of Baden and Saxony, whereas the largest firms are now all located in Berlin.

The advantages claimed for the special works, above all, are that industrial enterprises which only produce a limited portion of the extended manufactures in the electrical trades are able in general to utilise their means of production more favourably than in the case of undertakings which turn out a large number of very varied manufactures. In addition to this, the special works are rapidly able to understand and satisfy the requirements of customers, by personal contact, and are in many respects more capable of accommodating themselves, and are more mobile than the largest firms, in the management of which a certain bureaucracy cannot be avoided. The development of the special works has been largely supported by the circumstance that, apart from the contractors' offices and agents of the largest firms, an increasing number of firms have embarked upon the carrying out of installations, and in the course of time a separate branch of electrical contractors has developed in this way, who, being on the spot, and owing to their personal relations, their business and technical abilities, especially in large localities, have secured the work of executing lighting and power installations on a considerable scale. These particular contractors have naturally no interest in procuring machinery and apparatus from the largest firms, who are their greatest competitors through the installation offices which they maintain, but they have from the beginning given preference to the special works, and thus materially strengthened the latter.

It is further pointed out that the economic importance of the special works may be best illustrated by a few figures. It can be assumed that 125,000 workers are at present employed in the electrical engineering works in Germany, and 55,000 of these are engaged in the special works, which have an annual output of the value of from £16,250,000 to £17,500,000, or about 45 per cent. of the aggregate production of all the works. Naturally the special works, which restrict manufacturing to individual products, are of less extent than the large undertakings, although certain of the former are not only not inferior to the equivalent departments of the largest firms, but even surpass them. As a result of their great efficiency, the special works have secured a large circle of customers both at home and abroad. To these belong, on the one hand, the installation contractors and dealers, and, on the other, those local authorities and industrial undertakings which have departed from entrusting new installations or extensions in general enterprise to a large firm, but which now either carry out works on their own account with the assistance of their own engineers, or by requisitioning the services of consulting engineers, the individual requirements being obtained where they can be procured the cheapest. The special works are also interested in the export trade, and in certain countries to a larger extent than the big firms. This has caused some large firms to maintain branch works abroad, and meet, at least in part, the needs of the country concerned through them; and a second reason is that foreign customers are not so dependent in obtaining materials as are consumers in Germany, where the largest firms have secured by financial participation the supply of materials in the case of a number of undertakings, so that any competition must be useless in these particular instances.

BUSINESS NOTES.

Trade Announcements.—Messrs. Siemens Bros. Dynamo Works, Ltd., of Tyssen Street, Dalston, London, N.E., announce that they have made arrangements for additional telephone lines, which will shortly be in operation, thus obviating, they hope, further delay to customers consequent upon the rush of business on their present lines.

Messrs. Alex. Turnbull & Co., Ltd., St. Mungo Works, Bishopbriggs, Glasgow, manufacturers of boiler mountings, announce that Mr. Alexander Turnbull, the founder of the firm, has retired from the managing directorship, which position he has held since the incorporation of the company. He will, however, retain the chairmanship of the company and act as technical adviser to the board. Mr. John H. Johnson has been appointed general manager.

Messrs. Premier Electric Heaters, Ltd., have issued a large postal card illustrating a number of their electric heating devices, and announcing their removal to larger premises at 258, 259 and 260, Bradford Street, Birmingham.

The Rugby Lamp Co., Ltd., Rugby, have appointed Messrs. J. A. Rudd & Co., 68, Gordon Street, Glasgow, as their agents in Scotland for the sale of the "Rugby" metal-filament and carbon-filament lamps.

The A.E.G. Electric Co., Ltd., have opened an office in Birmingham—Winchester House, Victoria Square. Telephone, "7564 Central"; telegrams, "Circuit, Birmingham."

For the convenience of their friends in the South of England, Messrs. Hans Renold, Ltd., have opened an office in Kingsway House, Kingsway, London, W.C. It will be managed by Mr. Charles E. Holliday, M.I.M.E., who has held a leading position with the firm in Manchester for many years. At present the London office will deal particularly with matters requiring personal attention, ordinary inquiries and correspondence still being addressed to Manchester as hitherto.

Bankruptcy Proceedings.—W. H. Hunter, plumber and electrician, High Street, Towyn, Merionethshire.—The first meeting of creditors was held on Tuesday last week at the Town Hall, Aberystwyth, and later on the same day the debtor attended for his public examination before Mr. Registrar J. Baines. The statement of affairs disclosed gross liabilities £277, of which £234 was expected to rank for dividend. The assets were estimated to produce £239, leaving a surplus of £5. The failure was attributed to bad trade and family illness. It appeared that the debtor

started business in March, 1894, with a borrowed capital of £50, which amount had since been repaid. In 1904 he opened a branch business, but finding this did not pay he closed it after 12 months' trading. Afterwards the liabilities were £95 10s. and arrears of rent £13. It was reported that the debtor had lodged a proposal for a composition and the Official Receiver announced that the creditors had accepted the offer, which was one of 17s. 6d. in the £. This would come before the Judge for approval later. The 17s. 6d. would be paid by instalments of 5s. now, and 7s. 6d. and 5s. in two further instalments, payable six and nine months respectively from the date of the approval of the composition by the Court. The examination was closed.

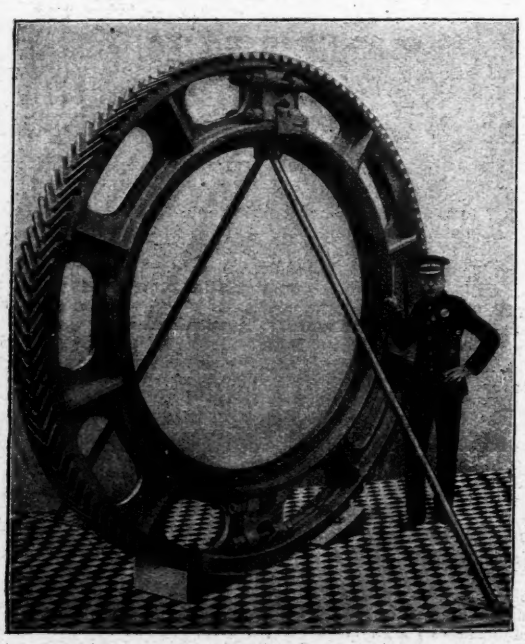
C. Braby, C. D. Green and T. Stirling, Jun., lately trading as E. & C. Braby, slate and marble merchants, Lambeth, London, S.E. —Mr. E. H. Hawkins, receiver and manager, announces a third and final dividend of 4½d. in the £, making a total payment of 5s. 7½d. in the £.

Morris Zains, lately electrical engineer and tobacconist, Wardour Street, Soho, London.—Receiving order made October 27th on creditor's petition. First meeting, November 11th; public examination, December 13th, both at Carey Street, W.C.

Citroën Helical Gears.—At the Manchester Engineering Exhibition Messrs. André Citroën & Co., of London, E.C., have a fine display of their machine-cut double helical gears. These helical gears are machine-cut with one tool in a single operation in the solid, and the teeth are continuous from one side of the face to the other. This gives the gears a maximum of strength, whilst the accuracy with which the teeth are automatically cut, combined with the principle of the double helical tooth itself, causes the gears to run with a total absence of noise, back-lash, shocks and vibration. That these advantages are actually obtained with the Citroën gears is proved by the various sets of gears shown running on their stand. One of the running exhibits consists of a set of double herring-bone gears, the teeth having three sections instead of two. This form of tooth has been adopted for reversing gearing, so as to equalise the wear when the load is being transmitted in both directions. The gears have been designed to transmit 100 H.P. at 800 and 50 R.P.M.; the single ratio is, therefore, 16/1.

The Citroën gears can be made in single ratios up to 20/1, which is of importance in connection with the ever-increasing demand for electric motor drives. It is, therefore, possible to use high-speed motors, which are, of course, cheaper and more efficient, and obtain the desired speed of the driven machine through one set of Citroën gears. Apart from their silent running, they have a high efficiency, which is claimed by the makers to be 98 per cent., and these high reduction gears therefore constitute a distinct advantage over worm drives.

Another exhibit on this stand is a large 10-ft. spur wheel, of which we give an illustration. It weighs about 3 tons, and is made



Large Double-Helical Gear Wheel.

for an electrically-driven tube mill. Many sets of this gearing have been made by this firm in connection with tube mills in South African gold-mines. We are informed that Messrs. André Citroën and Co. were awarded three Grands Prix at the Brussels International Exhibition.

Catalogues and Lists.—The St. Helens Cable and Rubber Co., Ltd., Warrington.—Interim price list (16 pages) of rubber-insulated wires and cables. Prices have been entirely re-arranged to cover the variations in prices of raw materials. All previous lists are cancelled. The contents consist of full tables of Association and Non-Association grades. The complete catalogue will be ready early in December.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Some further "Osram" advertising folders and a catching novelty card ("First Class") have been issued, and contractors can have their names printed on these, as usual. We have

Advertising Lamp Shade.

also received an "Osram" advertisement shade, such as is being circulated among contractors for window and showroom display. The shades are designed for ready attachment to existing lamp-holders, taking the place of existing shades, and forming an effective advertisement. We show one in the accompanying illustration. We cannot too often drive home this truth, that metallic-filament lamps "make electricity cheaper than gas."

Messrs. Donovan & Co., Barwick Street, Birmingham.—New trade price lists of electric cables, conduits and fittings, casings, and a variety of material and accessories.

The Electric Construction Co., Ltd., 9, New Broad Street, London, E.C.—New 20-page pamphlet, entitled "Machine Tool-Driving by Electricity," containing a number of large and excellent photo-process views of typical examples of machines driven by E.C.C. continuous and alternating current motors, car-wheel lathe, turret lathe for bar work, 7-ft. radial drill, lathes, planing machines, slotting machines, cold metal saws, and wood-working machinery. Most of the motors illustrated have ball bearings, these being used as standard by the firm up to about 30 B.H.P.; upwards of 2,500 such bearings have been fitted by the firm. A list of a few modern E.C.C. motor installations is tabulated at the end of the pamphlet.

The Abbey Electric Co., 17, Victoria Street, Westminster, S.W.—Twelve-page pamphlet illustrating and giving prices of the Abbey long-burning flame lamps, also a diagram of the feeding mechanism.

Messrs. Caspar & Co., 33, King's Road, St. Pancras, N.W.—Leaflet describing the "Gese" electric flash apparatus for advertising purposes.

The Huhn Tube Cleaner Manufacturing Co., 11, Queen Victoria Street, E.C.—Eight-page booklet describing their boiler-tube cleaner (Huhn's system).

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston.—Small card illustrating a couple of designs of outside electric lantern fittings, and giving prices; also Pamphlet HI, dealing with Holophane stiletto reflectors. Both of these circulars are for the purposes of the trade, whose names can be printed on if required.

The Hart Accumulator Co., Ltd., Stratford, London, E.—Illustrated circular showing and describing the Hart lighting type cells and patent non-corrosive terminals. Prices are given.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—November list (No. 106) giving data regarding the physical, mechanical and electrical properties of aluminium and copper, also particulars of round aluminium rod for switchboard and feeder connections, and a table of weights and resistances of aluminium wire.

The Electrical Power Storage Co., Ltd., 4, Great Winchester Street, London, E.C.—The company has just issued an export list of its well-known E.P.S. batteries. The various sections, indicated by a thumb index, relate to the following:—Acid and lead burner; 25 and 50-volt sets; 100 and 220-volt sets; 500-volt sets; ship-lighting types; moting cells; accessories, SH, DH and P type dimension diagrams; OM, and OL type dimension diagrams. Capacities, types, prices, code-words, and shipping weights and measurements, are given in table form throughout these sections.

Messrs. Lonsdale Bros., Ltd., Pump Street, Blackburn.—8-page pamphlet relating to their solidified silicate cotton (slag wool) covering for boilers, piping, &c.

The Rugby Lamp Co., Ltd., Lower Hilmorton Road, Rugby.—New price lists giving particulars and prices of the Rugby carbon and metal-filament lamps respectively.

Messrs. Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C.—New cardboard case in which one can most conveniently keep "Callender's pamphlets." The pamphlets already in it relate to Callender's marine glue, special safety fireproof cables, "Kalbitum" paint, "Kalanite" insulating material, jointers' hand-carts, and rubber wire store racks.

The British Thomson-Houston Co., Ltd., Rugby.—8-page list (No. 255) in B.T.-H. standard form, giving full particulars, tabulated prices and illustrations of their "Mazda" lamps; special shapes are included for railway carriage lighting, candle lamps, signs, and automobile lighting.

The Credenda Conduits Co., Chester Street, Aston, Birmingham.—24-page brochure entitled "Signs of the Times," containing some particulars of the Venner electric signs, a number of night photographs of actual examples in various parts of London showing how effectively these answer their purpose for illuminated advertisements outside theatres, stores, hotels, showrooms, shops, &c.

The Brilliant Arc Lamp and Electrical Co., Lonsdale Road, West Kilburn, London, N.W., and Vancouver.—Catalogue containing particulars, with illustrations, also price information, of their "Brilliant" enclosed arc lamps, "Brilliflamme" long flame lamp, "Brilliant" midget lamp, "Actinoræ" and "Inveræ" photographic arc lamps and accessories. The "Inveræ" lamp is specially designed for low-pitched studios. The lamps are all of English manufacture. Copies of the list may be obtained on application.

Dissolutions and Liquidations.—Synchronised Electric Clock Co., Ltd.—This company, of Leamington, is winding up voluntarily. A meeting of creditors is called by the liquidator (Mr. C. H. Waterman) for November 4th, at 11, Waterloo Place, Leamington Spa.

Westminster Tool and Electric Co., Ltd.—A meeting of creditors is called for November 2nd, at Palace Chambers, Bridge Street, Westminster.

Thornton & Crebbin, Ltd.—Creditors should send the particulars of their debts, &c., to Mr. J. H. Haley, 29, Tyrrel Street, Bradford, one of the liquidators, by November 30th.

Robson & Coleman, electrical engineers, Haymarket Lane, Newcastle-on-Tyne.—Messrs. R. E. Robson and A. C. Coleman have dissolved partnership.

Condensing Plant.—The Mirrlees Watson Co., Ltd., of Glasgow, have lately booked the following amongst other orders for steam condensing plants:—

Barometric jet condensing plants for an Antigua sugar factory; the Natal Estates, Ltd., Mount Edgecombe, Natal; an estate in Argentina; a South African sugar refinery, and for Messrs. J. G. White & Co., Ltd., for the Kalgoorlie Electric Light and Power Co.

Surface condensing plants for Fraser & Chalmers Ltd., for Erith Electric Works; the Melbourne Electric Supply Co., Ltd, for Geelong; the British Thomson-Houston Co., for Dublin United Tramways.

Low level jet condensing plants for the Harland Engineering Co., North Blaina Collieries; the British Westinghouse Co., for St. Helens Corporation; and Messrs. James Howden & Co., for Falkirk Corporation.

Consular Notes.—Poland.—The British Consul at Warsaw reports that the service of electric tramways in Warsaw continued to be very well worked in all respects during 1909. The cars are run regularly and are kept clean. The total cost up to the end of 1909 of the whole system was about £600,000. The total length of rails is about 50 miles. Three new lines came into operation; the number of cars and trailers was increased by 70, so that at present there are 210 cars and 60 trailers in use. In 1908 the number of passengers carried (partly by horse traction) was 42,500,000, which in 1909 had increased to 59,220,000. The distance run in 1908 was 7,900,000 versts (5,238,000 miles), and in 1909 10,700,000 versts (7,100,000 miles). The total income in 1908 was 2,372,000 roubles (£250,000), and in 1909 for nine months 2,437,000 (£256,400). The system is not sufficiently large for the requirements of the population, and a great many suburbs are as yet unconnected by tramlines. All extensions, however, are held up in consequence of the impossibility of obtaining credits from the municipality under the present uncertain state of affairs. In Lodz the mileage run by electric tramcars in 1909 was 3,285,129 versts (2,180,000 miles), 18,648,501 passengers were carried, 112 cars were in use, and the total net income was 922,410 roubles (£97,000), which, after payment of 5 per cent. to the municipality, allowed payment to the shareholders of 6 per cent. dividend and 2 per cent. bonus. Telephones became more popular than ever during 1909, and the number of subscribers rose from 14,817 on January 1st, 1909, to 17,744 on January 1st, 1910. This unexpected increase necessitated the construction of a new exchange, which, with the old one, is calculated to accommodate 50,000 subscribers. The service continues to be very good, and the rates of subscription remained the same, though there is some talk of a reduction. The telephone lines connecting Warsaw with Lublin and Cracow have not yet been completed, and, owing to unforeseen difficulties, some time will probably elapse before the project materialises. Telephones are being introduced on nearly all large estates, as permission is granted by the authorities more readily than was formerly the case. The system employed practically throughout the district is that of the Swedish Cedergren Co. The use of electricity for both power and lighting is rapidly increasing. The number of users rose from 2,300 on December 31st, 1908, to 3,142 on the same date in 1909; of these 2,405 were for light and 737 for power installations. The consumption of electric current for power and lighting in 1908 was 1,543,596 and 2,419,186 kw.-hours respectively; the figures in 1909 were 2,260,888 and 2,904,261. The prices of electric energy per kw.-hour are—(*a*) for lighting, 20·569 copecks (5·21d.); (*b*) for other power, 13·101 copecks (3·31d.) At Warsaw there was no extension of the electric lighting of the streets during 1909. At Lodz 650 arc lamps are being erected. At Biabystock, Government of Grodno, a new power station was built in 1909; all streets are lighted by electricity, and orders for new installations are so numerous that the company cannot cope with the work.

The British Consul at Warsaw also states that practically every branch of commerce offers openings for trade with the United Kingdom. There are, however, certain classes of commodities, such as boots and shoes, paints and varnishes, paper, heavy machinery, furniture, &c., which are all protected by heavy import duties, and consequently it only pays to import the very highest qualities in these lines. Cheaper qualities have to contend not only with the protective duties, but also with the articles smuggled from Germany and Austria-Hungary, from which the Jewish trader obtains the greater part of his profits. It has been pointed out that British firms rarely, if ever, advertise in the local daily Press or trade journals, while, on the other hand, this means of bringing wares to the notice of the Polish buyer is extensively resorted to by the German, Austro-Hungarian and French merchants. Foreign firms allow their local agent large sums yearly for this purpose, but so far as the Consul can see, it is only those British firms who have long had business connections with Poland who adopt the same practice.

It appears almost useless to reiterate the old complaint respecting the publication of catalogues and price lists in English only. Out of some hundreds of such publications received at the Consulate during 1909, not more than 10 were printed in any other language, and of these only three were in Russian, and not one in Polish. A few firms appear to have adopted the metric system for quotations in weights and measures, and those who quote foreign currencies seem to favour that of Germany. This in most cases is sufficient, except in out of the way districts.

Fewer commercial travellers than usual called at this Consulate during the year; but it is understood that there is a very considerable increase in the numbers of British travellers visiting Poland. Almost daily, however, on the other hand, the Consul has visits from one or two local merchants inquiring for the names of British manufacturers in every variety of business, and a large number of the callers have stated their intention of going to the United Kingdom and visiting manufacturers personally in order to enter into business relations. Frequent applications are made for the names of persons or syndicates willing to provide capital for building enterprises, mortgages, industrial undertakings and many other schemes. Many of these are no doubt excellent opportunities for the investment of foreign capital, but, on the other hand, many of them are ill-considered schemes, where the dreams of high profits are not founded on any practical basis.

The foundation of a Warsaw branch of the Anglo-Russian Chamber of Commerce at St. Petersburg should go far towards supplying a long-felt want as a source of reliable information.

In conclusion, British firms are again informed of the utter impossibility of doing business with Poland and, indeed, with all Russia, unless they are prepared to extend credit freely and thus compete with Germany and other foreign countries.

Book Notices.—*Annuaire pour l'An, 1911.* Paris: Gauthier-Villars. Price 1 fr. 50 c.—This is the annual publication of the Bureau des Longitudes, and contains numerous tables and statistics relating to metrology, geography and meteorology, in addition to the astronomical section. The *Annuaire* for 1912, on the other hand, will contain physical and chemical data.

The Gas Works Directory and Statistics, 1910-1911. London: Hazell, Watson & Viney, Ltd. Price 10s. 6d.—This is the thirty-third annual issue of this directory, and its contents are revised to August, 1910. There is not much to say, except what we have said in announcing previous editions. Plenty of information is given in very handy form regarding the gas undertakings and their officials, also associations of gas works managers and engineers. One section of the book relates to foreign and Colonial works.

English Prices with Spanish Equivalents. By S. Lambert. London: E. & F. N. Spon. Price 1s. net.—In view of the enormous field for trade in Spanish-speaking countries, this handy little book of conversion tables ought to fill a useful place on the business man's bookshelf. It starts at a rate of $\frac{1}{16}$d. per lb., and goes up to £1 per lb., the equivalents being given in £ per ton and in pesetas per kg. for seven different rates of exchange.

Die Unipolare Gleichstrommaschine. By Dipl-Ing. Boris von Ugrimoff. Berlin: Julius Springer.—In this thesis for the degree of Doctor in Engineering, the author discusses the theory and evolution of the unipolar dynamo, and describes the various designs which have been tried. Accounts of researches on rubbing contacts at very high speeds are included, and the author describes the construction and operation of a machine of his own design. The treatment is very complete, and the work is probably the most exhaustive yet published on this subject. The author is a Russian, trained at Moscow, Berlin and Karlsruhe, and is a lecturer in Electrotechnics in the High Schools at Moscow.

"Science Abstracts." Vol. 13, Part 10. Sections A and B. October 25th, 1910. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"*Bulletin* of the Engineering Department of the National Electric Lamp Association." September 1, 1910. Cleveland, Ohio: The Association.

"*Boletin* do Ministerio da Viacao e Obras Publicas." April, 1910. Rio de Janeiro: Imprensa Nacional. 1910.

"*Bulletin* of the Société Belge d'Electriciens." September, 1910. Brussels: Ramlot Frères.

LIGHTING and POWER NOTES.

Acton.—A town's meeting, of an importance and character never before witnessed in the district, was held at Acton on Monday night to protest against the recent decision of the Acton U.D.C., by 11 votes to 9, to hand over the electricity undertaking to the Metropolitan Electric Supply Co., Ltd., the principal points in the agreement being the transfer of the undertaking to the company for 42 years; the company to pay £5,000 in consideration thereof—£2,500 when the Bill receives Royal Assent, and the remainder when the concern earns over 6½ per cent. The meeting, presided over by Mr. Robert Clay, J.P., was held at the Central Hall, which was crowded to the doors. Mr. C. A. Buckmaster moved the first resolution: "That this meeting of ratepayers of Acton records an emphatic protest against the manner in which the decision to sell the undertaking to the Metropolitan Electric Supply Co. was obtained." The methods adopted, he said, were unworthy of Acton, and of its District Council. He deliberately accused the chairman of the Council of sharp practice in convening a meeting during the vacation at so short a notice as three days, when several members opposed to him were unable to be present. Very carefully arranged, and very unfair, was the deputation sent to the company, in that it comprised almost without exception those opposed to the undertaking—those who had publicly called it rotten. Mr. R. S. Whiting, seconding, said the character of the Council's action was not in accord with his idea of British fair play, and certainly not in the interests of Acton. It was undoubtedly a "rushed" meeting. Mr. H. S. Schultess-Young, chairman of the Council, greeted with hisses and groans, said he appeared before them as a sort of Daniel in the lion's den. He denied the allegations made, and said he was actuated by no other desire than to do the best for Acton, and to get to the meeting as many members as possible. The resolution was carried by an overwhelming majority. Mr. James Everitt next moved: "That the terms agreed upon for the sale of the undertaking seriously under-estimate its value, and should not have been accepted by the Council." Mr. A. G. Keen moved an amendment supporting the Council's action, which the chairman of the Council seconded. Both met with considerable interruption, and Mr. Schultess-Young was called upon to withdraw a remark addressed to a brother councillor, which the latter considered to be offensive and insulting, and eventually was advised by the chairman to resume his seat. Receiving very little support, the amendment was negatived, and the original motion carried amid loud cheers. Copies of both resolutions were ordered to be sent to the B. of T., the L.G.B., and Mr. Herbert Nield, M.P. for the division.

Aberdare.—The U.D.C. has adopted the following scale of charges for current:—Flat rate, 4d. per unit; by prepayment meter, 4½d.; contract rate, payable quarterly in advance, the amount of which will be assessed on the size of the installation on application to the electricity department, and 1d. per unit for current; fixed rate, 2s. 6d. per quarter, payable in advance, for each 32-watt lamp alight at one time, a minimum number supplied; for heating and cooking, 1d. per unit; motive power, from 1d. to 2d. per unit in proportion to the number of units taken per quarter for each KW. demanded.

Bacup.—At the T.C., on Friday last, it was reported that draft agreements with the Rawtenstall Corporation for the purchase of a bulk supply of electrical energy, and the management of the Bacup installation, had been approved, also that the B. of T. had intimated that it had no objection to the proposed arrangement, and that it had forwarded a copy of the drafts to the L.G.B. Amended estimates prepared by Mr. Taite had been submitted to the L.G.B. for the new arrangement, which amounted to £3,000, in respect of which application for sanction to a loan had been made.

Barnstaple.—The T.C. contemplates lighting the Rock Park by electricity, and a report on the scheme is to be presented by the electrical engineer.

Brighton.—The price of energy for the tramways has been reduced from 1·35d. per unit to 1·2d.

Birmingham.—At the recent L.G.B. inquiry in regard to the borrowing of £143,000 for extensions at the electricity department, it was stated that the estimated cost of the new plant at Summer Lane generating station was £129,450; at the sub-stations, Court Road, £3,444; Upper Trinity Street, £2,730; Camden Street, £2,580; Schofield Street, £450. An amount of £4,600 was included for a sub-station at Harborne, but was subsequently deducted, as the site had not been acquired.

Bispham (near Blackpool).—The B. of T. has written to the U.D.C., giving consent to the erection of the proposed generating station in Red Bank Road.

Bradford.—A deputation from the Electricity Committee recently paid a visit to the Smoke Abatement Exhibition at Glasgow, and the report which they have prepared shows clearly that the deputation consider it would be advantageous for a similar Exhibition to be held in Bradford. There was a great show of electrical appliances for the household. So far as the Exhibition went, the deputation formed the opinion that it was a complete success, and that a similar Exhibition in Bradford would not only be of advantage to the electricity and gas departments, but would tend to the promotion of good health and sanitation in the city.

Bridlington.—The T.C. proposes to open a showroom in connection with the electricity department, and a committee has been deputed to report upon the showrooms at York and Hull before a definite step is taken.

Bromley (Kent).—By arrangement with a number of local tradesmen, the Electric Supply Co. proposes to install nine arc lamps suspended over the middle of the highway between Martin's Bank, High Street and College Slip. The idea is to brighten up that particular part of the borough, and the cost will be borne by tradesmen in the area. The consent of the T.C. to the scheme has been sought.

Continental Notes.—GERMANY.—A transmission scheme at 110,000 volts, which is said to be the highest pressure hitherto used in Europe, has been entrusted to the Siemens-Schuckert works by the Lauchhammer Co., which is engaged in the iron and steel trade in Germany. The order comprises a complete transformer and switch installation for power transmission to the company's works at Grodnitz and Riesa, as well as for the supply of the network of the Groba power station. Two long-distance lines, each for a transmission of 15,000 KW. at 110,000 volts, are to be erected. The highest pressure so far used in Germany is stated to be 50,000 volts, and is employed for power transmission between Moosburg and Munich. On the other hand, the Bergmann Electricity Co. also refers to the Groba scheme, which is said to represent the construction of the largest power station in Germany. The final preparations for the work have been made, and the orders have been given out by the Groba Electricity Union to the firms concerned. The project relates to the supply of electricity in 750 localities in the kingdom of Saxony, and the current is to be stepped up to 60,000 volts (110,000 volts ?) for long-distance transmission. The execution of the works, it is added, has been allocated to the Bergmann Electricity Enterprises Co.

An exhibition, styled "Electricity in the Household," is being arranged at Leipzig by the Elektrotechnische Vereinigung in the middle of the current month (November). It will consist of a series of furnished dwellings completely equipped with electric domestic appliances. The object is to popularise electrical appliances.

A German return quoted in the *Iron and Coal Trades Review* shows that in the case of 363 collieries circularised, particulars are given of 737 compressors in use, 564 being steam driven (183,178 H.P.), 77 electrically driven (7,252 H.P.), and three gas driven (580 H.P.). A further return, however, appears to show 120 electrically-driven compressors.

BELGIUM.—The electricity generating plant at the extensive works of the Cockerill Co., at Seraing, near Liège, is now supplying current to 1,104 arc lamps, 6,028 incandescent lamps, and no less than 717 electric motors of different sizes. The plant is being increased by a new gas engine and dynamo, the necessary gas being drawn from the coke ovens.

TURKEY.—It is reported from Buda-Pesth than the Sultan of Turkey issued on October 24th an order confirming the contract with the Ganz Electricity Co. and the Buda-Pesth Co. for electricity and traffic undertakings in reference to the establishment of electric light and power works in the European part of Constantinople. The carrying out of the works will involve an expenditure of £833,000, and for this purpose a syndicate, under the lead of the Hungarian Credit Bank, will be formed with the assistance of the two companies mentioned, and of a French and Belgian group, including the Banque de Bruxelles, which will co-operate in the floatation of the bonds to be issued. The association with foreign groups will bring, as previously reported, the Stamboul gas works, into the possession of the syndicate.

SPAIN.—In the Toledo district, the Civil Government has been approached by Don Luis Iribarre, of Arce, for permission to utilise a waterfall on the River Tajo, within the city's administrative area, for the generation of current for industrial purposes.—*Electron.*

AUSTRIA.—The district authorities of Reichenberg (Bohemia) are considering the details of a scheme for the erection of a central station on the Hirschfeld, and the construction of a network of overhead lines to supply 19 communities in the districts of Reichenberg, Friedland and Bratzau.—*Elekt. und Masch.*

FRANCE.—The accounts of the Parisian Electricity Co. for 1909-10 show a profit for the year of about £192,174, of which £803 was brought forward from 1908-9. The Council of Administration recommends a dividend of 12s. 10d. per share for 1909-10, after providing for fixed charges, and carrying £32,000 to the renewal fund.

Eccles.—The members of the Corporation have been gratified with the receipt of a report on 12 months' experimental lighting of a block of Corporation dwellings in the centre of the town. The supply of electric light was unrestricted, and a charge was made of 6d. per house added to the rent. It was stated that the actual cost had worked out at 4d. per week, and the Committee is prepared to treat with owners of blocks of property to make a charge on the basis of the rentals.

Finchley.—The following assessments have been dealt with by the overseers: National Telephone Co.'s wires, &c., increased from £50 gross £40 rateable, to £218 and £115; North Metropolitan Electric Power Supply Co., increased from £512 gross £256 rateable, to £1,200 and £700; Finchley District Council's electricity undertaking, increased from £400 gross £320 rateable, to £4,300 and £1,800.

Gloucester.—At the last meeting of the T.C. it was reported that in view of the rapidly increasing output of the electricity department the existing plant would have to be supple-

mented before the winter of 1911-12, and that the engineer had presented a report detailing the probable requirements with estimates of the cost. The expenditure covers the provision of a steam turbo-generator, feeder, and distributor mains, boiler house plant, &c.

The Council decided to apply to the L.G.B. for sanction to borrow £14,000 for the purpose of extensions to the plant and distribution systems of the electric supply undertaking.

Hessle.—The Hull E.L. Committee has consented to confer with a deputation from the U.D.C. on the question of electric supply. Hessle desires Hull to work its E.L. order, if terms can be arranged.

Luton.—The T.C. has decided to apply for a loan of £2,396 for a Clarke-Chapman (Woodeson) boiler with superheater, an underfeed stoker, extension of coal bunkers and economiser, motor-driven feed-pump, &c.

The mains are to be extended to Cobden Street at a cost of £250 in order to supply current for smelting purposes to the Electric Furnaces and Smelting Co., Ltd. The cables are also to be extended to the Corporation sewage works, to the works of the Skefko Ball-Bearing Co., Ltd. (cost £1,735), and the works of the West Hydraulic Engineering Co., Ltd. (cost £300). The Smelting Co.'s works open up another new industry for Luton.

Limerick.—The special meeting of the E.L. Committee to consider a report by Mr. Aubrey V. Clayton on the working of the electricity undertaking, held last week, makes interesting reading in the *Cork Examiner*. Mr. Clayton apparently found the installation in a neglected and dirty condition, and commented on the lack of system and discipline in all departments. Four gas engines are in use; No. 4 refuses to work more than a few minutes at a time; No. 3 has a bent crankshaft; they are all in such bad plight that Mr. Clayton does not think much money should be spent in overhauling them. The switchboard has been consigned at different periods to the scrapheap; battery room, totally neglected; distribution boxes, lids not fastened on, and in one case left off, brick chambers full of dirt and containing water, &c.

London.—Fulham.—In connection with the scheme for the wiring and fitting of consumers' premises for electric light, 78 applications have so far been received, and of these 35 have already been connected to the mains. The work incidental to the wiring of the premises under this scheme is reported, the Electricity Committee say, to have been most efficiently carried out, and the arrangements and fittings afford complete satisfaction to consumers. In June last authority was given to the Gas Light and Coke Co. to substitute inverted for upright incandescent burners in six of the public lamps at Parson's Green, between New King's Road and the District Railway Station, to demonstrate its contention that improved efficiency and economy would be obtained by the alteration, and it was proposed, subject to the experiment proving satisfactory, to place a scheme before the Council for the conversion of the whole of the remaining gas lamps in the borough upon reasonable terms. Having inspected the new burners, the Lighting Committee is, however, of the opinion that there is not sufficient improvement in the lighting to justify the expense of altering all the remaining lamps in a similar manner, and it has instructed the town clerk to so inform the Gas Co.

Bermondsey.—The Electricity Committee reports that the electrical engineer had informed it that the maximum load had been reached, 1,622 kw., against the highest load in October, 1909, 1,300 kw. Six of the feeders are almost fully loaded at this output. It will therefore be essential to strengthen two of the feeders and the distributors in six roads, and to join two distributors, the estimate for the work being £5,261. The Committee goes on to say that it was very gratifying to know that this large increase in load has resulted in a corresponding increase in revenue. The increase in revenue for the six months just completed (the summer six months being by far the lighter half of the year) is equal to the estimated increase in revenue for the whole of the year.

The B.C. on Tuesday evening considered a report of the Finance Committee with reference to the request of the Electricity and Street Lighting Committee for an estimate of £150, the cost of the application to the B. of T. for a provisional order to enable the Council to supply electricity to the parishes of St. Olaves, St. Thomas, and St. John's, Horsleydown. The Committee desired to know whether this sum and £200 mentioned as being requisite next year, represented the total cost of obtaining the order, and the subsequent confirming Act of Parliament, and whether, in the event of the Act being obtained, it was the intention of the Council to exercise its powers under it. The Committee also desired to know the estimated outlay and probable profits, both inclusive and exclusive of street lighting, and the estimated cost of street lighting by electricity as compared with gas. Mr. J. W. Oake proposed that in the event of an Act of Parliament being obtained, the Council would take steps to exercise its powers, and that the Finance Committee be authorised to submit an estimate. He was sorry the Finance Committee had taken up its present attitude, which was only done to cause unnecessary delay. The Council, by 25 votes to 18, adopted Mr. Okes's resolution.

Woolwich.—The town clerk has issued a circular letter to the other metropolitan B.Cs., stating that the Woolwich Council is of opinion that, having regard to the fact that explosions have taken place owing to the escape of gas into street boxes constructed by the Post Office, the Telephone Company, electric lighting and other similar authorities, such boxes should be ventilated in order to prevent the possibility of such explosions. In order to ensure a uniform system of ventilation, Woolwich Council, has addressed a communication to the London County Council, asking that authority to consider the advisability of framing regulations to secure such ventilation. It is intended that the regulations should apply to the whole County of London, and that they should be enforced by the various local authorities.

Marylebone.—The Electricity Committee reports that on June 22nd last the Council resolved to discontinue the £2 2s. annual payment in respect of "other uses" of current in the case of private (residence) consumers adopting the "telephone" system for lighting. This has resulted in a very big increase in radiators, &c., and the department has gained considerably by the reduction. The Committee finds now that the £2 2s. (which at present brings in an almost negligible revenue) is a bar to business premises adopting radiators and "other uses" of electricity, and feeling sure that if this charge were discontinued an equally large increase of business would result as has been found to be the case from private residences, it has resolved (subject to the usual sanction) that the annual charge (telephone system) in respect of the use of electricity for all purposes (other than lighting and motors) be discontinued.

North Berwick.—It is stated that an agreement has been practically come to between the T.C. and Messrs. Crompton for the introduction of E.L. into the burgh.

Peterborough.—The L.G.B. has sanctioned the borrowing by the Council of £2,000 for extending the electricity undertaking; the proposal met with opposition at the local inquiry.

Porlock.—The Somerset C.C. has granted an E.L. company permission to erect poles on the main road at Porlock for the purpose of supplying the village with electricity.

Portrush.—A special meeting of the Council was held on the 28th ult. for the purpose of considering the advisability of adopting the report of Messrs. Miller, Wilson & Pegg, Belfast, who recommended the lighting of the town by an electric scheme at a total cost of £6,332. In reply to a question, Mr. Pegg said that he had allowed in his estimate a sum of £557 to cover the granting of a provisional order, engineering expenses and legal expenses. The Council having gone thoroughly into the matter, it was finally decided, by 10 votes to nil, to apply for a provisional order to carry out the scheme, which has been hanging off and on for the best part of a couple of years.

Rawtenstall.—The Corporation has resolved that application be made to the L.G.B. for sanction to borrow £2,000 for the outlay in cables, fittings, brackets, &c., in connection with the proposal to light the main thoroughfares of the borough with electricity.

Rugby.—The U.D.C. has reduced the price of electricity for motive power as under:—Less than 100 units per quarter per H.P. installed, 2d. per unit; above 100 and under 200, 1½d.; beyond, 1½d.; for domestic heating and cooking, 1½d.

Southampton.—The electrical engineer has submitted to his Committee a preliminary report relative to the powers obtained under the Southampton Corporation Act, 1910, respecting the wiring of private property. He put forward three methods by which the cost of such work could be charged for or repaid. The engineer is to obtain further information on the matter, and report again. As the footpaths in 10 roads are about to be repaved, spare ducts are to be placed in these at an estimated cost of between £120 and £130.

Sutton (Surrey).—At the last meeting of the U.D.C., the question of public lighting generally was discussed, and it was decided to advertise for tenders and to invite suggestions as to the best means of lighting. The Council agreed to take these into consideration in determining which tender should be accepted. The public lighting of Sutton has been changed from gas to electricity in recent years, after a keen struggle between the rival local companies, and it is expected that competition will be equally keen when the tenders are considered. The accepted tender will cover a period of 13 months from March 1st, 1911.

Mansfield.—The U.D.C. has decided to give moral, but not financial, support to the Bill of the I.M.E.A., seeking powers to enable local authorities to supply lamps, fittings, &c., and to undertake wiring work.

Newark.—At a recent meeting of the U.D.C., a letter was read from Mr. C. Pullon, stating that he noticed an objection to Newark by certain firms who desired sites for works, on account of the lack of a public electricity supply. Mr. Pullon pointed out that he was endeavouring to form a company for the provision of a public supply, and he hoped soon to have the arrangements completed. The letter was referred to a Committee.

Newmills.—The U.D.C. has asked the Huddersfield T.C. for terms for the supply of electricity in bulk or otherwise.

Spennymoor.—At the Dean and Chapter Colliery of Messrs. Bolckow, Vaughan & Co., additional coke ovens, with a washery and by-product recovery plant, have recently been added. The waste heat from the ovens is utilised under 12 Lancashire boilers. The new plant is all electrically driven, and a 750-kw. B.T.-H.-Curtis mixed-pressure turbine has been added in the power house. Normally this plant runs on exhaust steam supplied from three winding engines and various auxiliaries, and exhausts to a Mirrlees-Watson barometric condenser.

Swansea.—We are informed by Mr. Prussmann, the borough electrical engineer, that the statements attributed to him in our last issue, in connection with the the proposed weekly day of rest in the E.L. department, are incorrect. The Swansea Committee unanimously voted in favour of the proposal, and the minute was unanimously confirmed by the Council on October 19th. We regret that we were misled in this matter.

Todmorden.—On Saturday an additional engine and dynamo at the Corporation electricity works was started. The cost of the new machinery is over £1,000, and makes a total of over £21,000 spent on the works since their commencement five years ago.

Torquay.—The Electric Light Committee has rented a shop in Fore Street for three years for the exhibition of electrical fittings. The Committee also decided to make more widely known the advantages of electric lighting.

Wolverhampton.—The T.C. has received from the L.G.B. notice that an inquiry will be held on November 8th into the application for a loan of £20,925 for electric lighting purposes and a refuse destructor.

TRAMWAY and RAILWAY NOTES.

Bacup.—The town clerk has submitted specifications for the construction, &c., of the new electric tramway from Bacup to Shawforth, which he had received from Mr. Moffett, of the Rochdale Corporation Tramways, and a report from Mr. Taite favourable thereto. The specifications have now been agreed to between the respective engineers.

Birkenhead.—Owing to their cumbersome nature and on account of their heavy wear and tear of the permanent way, the Corporation Tramways Committee has decided to alter the big double-bogie cars used on the Prenton and circle routes, so as to render them lighter, the motors being reduced from four to two in number. The Prenton people, however, are opposed to the change, claiming that the cars ensure comfortable travelling.

Blackpool.—The T.C. has applied to the L.G.B. for a loan of £4,000 for six new tramcars.

Bournemouth.—On Friday last the T.C. approved of a report recommending the substitution of the overhead trolley system for the conduit system on the tramways at present in existence in the centre of the town. It is stated that £3,000 per annum will be saved by the change.

Burnley.—Major Druitt, of the B. of T., conducted an inquiry on October 29th relative to the application of the Corporation to increase the speed of cars on various sections of the electric tramways. It was mentioned that in 1900, Burnley had powers to run cars at 12 M.P.H., and in 1908 Parliament granted a maximum of 16 M.P.H. The local drivers had attained a state of efficiency, and there was an immunity from accidents. It was stated that Preston had a maximum of 14 miles and Blackburn of 12 miles. Various surrounding authorities, who benefit by Burnley's service, objected to any increase on the ground of public safety. Major Druitt inspected the various routes, and he will present his report in due course.

Haslingden.—The through running of the electric cars between Accrington and Bacup, which has now been in operation six months, appears to be giving general satisfaction. At the last meeting of the Haslingden T.C., it was reported that, compared with the same period last year, Haslinden had a net gain of £320 in increased traffic and reduced car-mileage, while Accrington and Rawtenstall were each saving £250 a year by working the route with 11 cars instead of with six each, which were necessary before the through service came into force.

Continental.—GERMANY.—The important town of Gummersbach, in the neighbourhood of Cologne, has decided on the construction, at an estimated cost of 2,000,000 marks, of an electric normal-gauge railway, connecting that town with Niedersessmar, Frömmersbach, Derschlag and Dummlinghausen. The line is mainly for industrial purposes; passenger traffic will be chiefly served by the section to Niedersessmar.—*Elek.-u-Masch.*

The Communal Council of Wahn in the Rhineland has decided upon the construction of an electric normal-gauge tramway, to carry goods and passengers, from Porz to Beuel with branches to Siegburg, as a continuation of the Cologne-Porz suburban line, with junctions for goods at the State railway stations at Porz, Troisdorf, and eventually Beuel.—*Elek.-u-Masch.*

An inspection has just been made of the Schoneberg (Berlin) underground electric railway, which has been constructed by the Siemens & Halske Co., and is to be opened for traffic in December. The railway, which commences at the Nollendorf Platz and ends in the Haupt Strasse, has three intermediate stations at Viktoria-Luise Platz, Bayrischer Platz, and the Stadtpark, and has a total length of 2·17 miles, the complete journey being accomplished in 6½ minutes. An entrance to the existing elevated and underground railway is being constructed at the Nollendorf Platz, and will lead directly to the platforms. An innovation in connection with the new railway is the provision, between the stations, of safety shafts which have convenient steps leading to the street level, so that passengers may utilise them in case of emergency. The shafts were required by the police authorities as a result of the Paris underground railway disaster a few years ago.

FRANCE.—The T.C. of Samois (Seine-et-Marne) has under consideration the desirability of introducing an electric tramway system.

The T.C. of Argenteuil has passed a resolution calling for the electrification at the earliest date possible of the Paris-St. Lazare-Argenteuil railway.

The Minister of Public Works has just announced his approval of the agreement come to between the gas company and the Prefect of Indre-et-Loire, regarding the works to be undertaken for the conversion of the Tours to Vauvray steam tramway to electric working.—*Revue Pratique de l'Electricité.*

A large electric tramway scheme to unite some 12 towns and villages with the populous City of Toulouse is being actively considered. It is proposed to utilise the public highways for only a short distance—5 or 6 km.—the rest of the track being on private ground, so that trains may be run up to a speed of 60 km. an hour. The scheme originated at Mazamet, where it has received the advocacy of the Conseiller Général for that town, many other members of the Conseil Général of the Department of the Tarn being also in favour of it.—*Revue Pratique de l'Electricité.*

Two deputations connected with the Municipality of Paris are visiting London, in order to compare the merits of the side and centre slot systems of conduit tramway construction. Whichever is adopted in Paris, the work of reconstruction will cover 75 miles of tramways, and occupy some years.

AUSTRIA.—The plans for a 4·6 kilometre narrow-gauge electric rack railway, from Draga di Lovrana up the Monte Maggiore, submitted for official approval by the Vienna Union Baugesellschaft, have undergone the customary official scrutiny, and the line will consequently be forthwith commenced. Being on the Italian border, attention had to be given to various political considerations.—*Elektrotechnik und Maschinenbau.*

SPAIN.—The *Electron* gives the following particulars of the projected Franco-Spanish trans-Pyreneean railways: The extraordinary variety of levels which affect the trans-Pyreneean railways, and the abundance of hydraulic power available in those regions, have contributed to the adoption of electricity as the most convenient driving power. Power to work the Oloron to Jaca line will be supplied by the Salomne station, which will utilise the Gave de Pau and Cauterets Falls for its generation, these being capable of developing up to 21,000 H.P. The Aix-les-Termes to Ripolli railway will obtain power from the station at Eget, which utilises a less important waterfall. On all the railways single-phase alternating current will be supplied to the overhead lines at 12,000 volts, but from the central stations it will be delivered to the railway at 75,000 volts. The three-line system is that adopted, return being made by the rails. The posts will be of metal, placed 100 metres apart. The rolling stock comprises two types of locomotives—the larger weighing 70 tons of a capacity of 1,000 to 1,800 H.P., and the smaller of a capacity of not above 500 H.P. The former are for use with express trains, which they will be able to draw at a speed of 100 km. an hour, and the latter for local trains at low speed. According to the proposals of the companies, all trains will be worked electrically so soon as they are able to command sufficient hydraulic power. The trans-Pyreneean railways mentioned, expect to be working within two years, but the sections on Spanish territory will need a much longer time, as the works have hardly been begun yet.

Hounslow.—The Tramway Co. has sent an intimation to the clerk of the Council that 140 of the cars are to be covered, and that they are to be turned out at the rate of five a week. With regard to the noise of the cars the company is now engaged in welding the joints on the Uxbridge route at a cost of £2 a joint. When this work is finished the lines between Chiswick and Hounslow will be taken in hand; it is expected about January. The extension work at the Council's electricity station is practically finished, and it is expected that the plant will be running in a few days.

Japan.—According to the last Japanese mail, an English syndicate is reported to be forming a company with a capital of £1,000,000 to construct and work an electric railway between Hiratsuka, Hachioji and Takasaki.

The new branch of the Odawara electric tramway, between Koza and Yumoto, has just been completed and opened for traffic.

Kirkintilloch.—At a public meeting the unsatisfactory issue of the action taken by the T.C. in furthering the extension of the Glasgow Tramways was condemned, and a deputation was appointed to wait on the Glasgow Corporation.

Lanarkshire.—Correspondence has been proceeding between the Lanark C.C. and the Lanarkshire Tramways Co. as to the latter's intentions regarding the completion of various extensions still to be constructed in the area of the county, and Mr. Clements, the company's secretary, has written a letter in which he states that, in view of the fact that the Motherwell Coporation did not expect to be able to complete the alterations to Coursington Bridge before the expiry of the company's powers, and the impossibility of raising capital for tramway extensions in the present state of the market, it was decided to make an application to extend the time for completion of the tramways for a further three years. The Council's Committee expressed extreme disappointment and dissatisfaction at the terms of the company's letter, and unanimously agreed that the company's representatives be asked to discuss the whole matter with it. The Council has concurred.

London.—Commencing with Tuesday, the Metropolitan Railway Co. increased the number and speed of its trains between central London and the suburbs, and on the inner circle route, 31,000 seats per week being added on the latter.

Middlesex.—At the meeting of the C.C., on October 27th, it was resolved that, subject to the L.G.B. sanctioning the borrowing of the purchase-money, notice be given to the L.C.C., requiring it to sell to Middlesex the portion of the Highgate Hill tramways in the County of Middlesex. It was mentioned that the approximate purchase price was £5,000. The C.C. approved of £13,621 being transferred by the Metropolitan Electric Tramways, Ltd., to the reconstruction and renewals fund out of the revenue of the company for the year ended December 31st last, and invested in the joint names of the Council and the company in India 3½ per cent. stock. The proposal of the Metropolitan Electric Tramways, Ltd., to run a "shuttle" service over the section of light railway from the Great Eastern Railway Station, Enfield Town, to the junction of Southbury Road with the Hertford Road at Enfield Highway, was approved.

Rochdale.—The Tramways Committee has decided that 59 cars be fitted with meters for registering the current used, at a cost of £206 10s., *i.e.*, £3 10s. per car.

Salford.—A correspondent states that the local Tramways Committee has decided to appeal against the assessment of the tramways in the Salford and Pendleton townships.

Walthamstow.—With a view to reducing the consumption of energy, the Tramways Department is to obtain, at £3 5s. each, 12 ampere-hour meters, and have them fixed on 12 cars. The makers of the meters are supplying them on condition that, if the meters fail to effect a reduction of 5 per cent. in the consumption of energy, they may be returned within six months.

Torquay.—The town clerk has received an intimation from the B. of T. that it will renew the licence for the continuance of the running of the Torquay cars. In May last notice was given by the Board that the licence would not be renewed unless a considerable improvement was reported with reference to the number of "live" and "dead" studs; but since that time a great deal has happened. It is extremely doubtful whether an improvement has been reported; but in view of the probability of the tramways being converted to the overhead system, the Board has extended the period, representations having been made by the Council as to the inconvenience which would be caused to the townspeople by the stopping of the service.

Scarborough.—Col. Von Donop held an inquiry, on October 28th, into matters arising out of the notice of the Scarborough Tramways Co. to discontinue the winter service of tramcars.

The Town Clerk said the Corporation did not offer any opposition to the company's not fulfilling its obligation with regard to the service of cars on the north side during the winter, but when the company announced its intention to abandon the whole of the service during the winter months, the matter assumed a totally different aspect. The Corporation then, in the interests of the ratepayers, took action under Sec. 92 of the Scarborough Tramways Act, 1892, and asked the B. of T. to decide what service of cars the company should provide in accordance with its statutory obligations. Before taking action, the Board suggested a conference between the Corporation and the company, at the Board of Trade offices. That took place, and on behalf of the Tramway Co. a statement was made that unless the Tramway Co. was released from running the service of cars in the winter, it would be compelled to abandon the undertaking altogether. Mr. Marwood, representing the B. of T., accordingly suggested that the Corporation should consider the situation in the light of that statement. The Corporation held two meetings in committee, and it was stated that during 1909 the total loss of the company was over £2,000; that the cost of the undertaking was £100,000; that nothing since the opening of the service had been set aside for depreciation, and that there was a considerable sum owing to individuals who had advanced money on the security of the tramways. Looking at those figures, it was difficult for the Corporation to understand how a saving of £700 during the winter would materially help the company, and for that reason alone it felt it obligatory to ask the B. of T. to give a decision. The Corporation considered that the balance of public convenience was in favour of total abandonment of the undertaking rather than partial continuance during the summer months. In taking up that attitude, the Corporation fully realised that the tramways were undoubtedly appreciated by visitors during the summer months, and added to the amenities of the town, but against that there were objections, some of a sentimental character and others of a practical nature, to the running of tramcars in a health resort like Scarborough. The streets were not wide, and the running of cars caused great inconvenience, so that many occupiers of business premises were not in favour of the running of tramcars.

Councillor A. Moore, chairman of the Streets Sub-Committee, said that in the event of the cars being suspended entirely during the winter months it was in the interest of the town that they should clear off altogether, because the Corporation had been unofficially informed that probably another means of transit would be introduced which would serve the town much better or equally well. In reply to the Inspector, Mr. Moore said he thought the town would be satisfied in winter with the half-hour services from nine to eleven, and quarter-hour services afterwards.

Evidence was also given in favour of the case of the Corporation by other members of the Council.

Mr. F. E. Gripper, one of the directors of the Tramway Co., said the company had done all it could to foster the tramway service in the town. It gave a full winter service in 1904-5, and it had tried a varied service since. It had tried a larger and a smaller number of cars during the winter, and the more cars the company had run the more money it lost. The real point was—What was a reasonable service? The North side winter service was suspended when the company discovered it was receiving not much more than 2d. per car-mile. The total cost of running last year was 8·5d. per car-mile, and the takings in the summer were 8·7d. per car-mile, but in the winter the company had never received more than 5½d. per car-mile. In 1905 the profit on the tramways was £1,747; in 1906 the profit was £1,100, and that went in interest charges. In 1907 there was an actual loss of £21; in 1908 that loss was turned into a small profit. In 1909 the company lost £667 on the working. There was a considerable amount of money due to the mortgagees of the undertaking, and the mortgagees would not lend any more. Even if the B. of T. allowed the company to discontinue the service in winter, it might still be found necessary to shut down altogether.

Dr. F. Dale also made a statement on behalf of the company and the inquiry closed; meanwhile the winter service continues.

TELEGRAPH and TELEPHONE NOTES.

All-Red Cables.—A rumour that the control of the Atlantic cables may shortly be taken over by an American trust has led to a renewed demand for an "All-Red" cable route between the United Kingdom and the Dominions. An All-British Atlantic cable is the link that remains to complete the route to Canada, Australia and New Zealand; the Eastern and African routes are already "All-Red."

Cab Rank Telephones.—Trials are being made by the National Telephone Co., Ltd., at the cost of the Commercial Motor Users' Association, of a telephone box of the fire alarm type, which can be fixed at a cab rank where no shelter accommodation is provided. Hitherto only shelter ranks have been provided with telephones.

French Telegraph Union.—A judgment dissolving the union of post and telegraph servants has been upheld by the Court of Appeal, on the ground that postal employés, as servants of the State, cannot be allowed the same privileges as obtain in the case of the employés of private concerns.

Germany.—At the second German Marine Navigation Congress, a resolution was passed on the subject of wireless telegraphy, which, together with the report of the proceedings, was submitted both to the Imperial Post Department and to the German Admiralty. The reply of the former stated that the extension of wireless telegraphy was the subject of his constant consideration. The Admiralty remarked that experiments with a view to the extension of storm warnings by land and sea would be made in the course of the current year.—*E.T.Z.*

Italy.—A Commission has been appointed to go thoroughly into the position of telegraphic communication in Italy, and lay before the Government such proposals as will tend to improvement in technical, administrative and economic aspects.—*E.T.Z.*

Japan.—The Japanese Government has just acquired and taken over the telegraph cable between Fusan and Tsushima belonging to the Great Northern Telegraph Co. The original charter does not expire until 1914, and it is stated that the price paid by Japan has been based on the profits which would have accrued to the Telegraph Co. during the next four years. The Government has also decided on the laying of a direct cable between Shimonoseki and Fusan.

Letters by Telephone.—The minimum 60 words hitherto fixed for telephonic letters or express letters has been abolished. As from November 1st, where a telephonic message is transmitted to a post office for further transmission as a letter or as an express letter, each 30 words of such message (or any less number of words over and above 30, or any multiple of 30) will, for the purpose of the charge for such further transmission (but not for any other purpose), be treated as a separate letter or express letter as the case may be. The postal charge for a telephonic letter to be transmitted by ordinary post will in future be 1d. for each 30 words.

London-Paris Telephones.—It is announced that two new telephone lines between London and Paris will be open for public use at the end of this month, and that two others will be in operation next spring. With these lines in operation it is expected that 400 conversations per day can be effected between the two capitals.

Post Office Report.—The annual report of the P.M.G. on the work of the Post Office has just been issued; we shall deal with it in our next issue.

Spain.—A Bill has been introduced into the Spanish Parliament to devote a sum of 12,353,000 pesetas to telegraphic works. The money will be applied (1) for the improvement of the existing installations, both lines and stations, and for fitting tele-

phone apparatus in 888 telegraph offices; (2) for extensions, including erection of telephones in villages of less than 2,000 inhabitants who request such installations, the laying of a cable between Barcelona and Genoa and Cartagena and Oran, &c.—*Electron.*

Telephone Shocks.—According to reports in the daily Press, hooligans broke into the electric power station (? sub-station) at Vitry-sur-Seine on Sunday last, and disorganised the high-pressure circuits, some of which came into contact with telephone wires. Several persons who attempted to use the telephones received violent shocks.

Telephone Staffs.—At a meeting of the City and Trunk Exchange staffs of the Post Office, London, on Thursday, last week, a resolution was passed protesting against "the systematic understaffing of the London telephone exchanges," and ascribing to the alleged understaffing "the evils which at the present time are having such disastrous effects upon the health of telephonists." The resolution also called upon the P.M.G. to publish the findings of the Medical Commission appointed by him to inquire into the cause and prevalence of hysteria and nervous complaints.

Wireless Telegraphy.—A wireless telegraph station is to be installed in connection with the development of the Cromarty Firth as a naval base in the North of Scotland. The buildings will consist of a telegraph station, engine room and dwelling house.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia. — November 19th and 22nd. Telephone cable and testing instruments, for the P.M.G.'s Department. See "Official Notices" October 7th.

N.S.W.—November 16th. Telephone, telegraph, and electric light material, for the P.M.G.'s Department in New South Wales. See "Official Notices" October 21st.

January 4th, 1911.—Three multiple switchboards, for the P.M.G.'s Department in New South Wales. See "Official Notices" to-day.

November 23rd.—Cable, ironwork, pipes, conduits, switchboards, telegraph and telephone instruments, &c., for the P.M.G.'s Department in Queensland. See "Official Notices" September 30th.

December 29th.—(*a*) Telephone cable, (*b*) battery and line material and instruments, for the P.M.G.'s Department in South Australia. See two "Official Notices" to-day.

Austria.—November 20th. The Austrian State Railway authorities in Cracow are inviting tenders for the establishment of electric lighting plants at the railway stations at Rzeszow and Rzeszow-Staroniwa.

Bispham-w.-Norbreck.—November 21st. Gas producer and electrical plant for the proposed generating station, for the U.D.C. See "Official Notices" to-day.

Bootle.—November 17th. For supplying and fixing a complete installation of electric light at the new Balliol Council Schools. Specifications from the Borough Electrical Engineer.

Bradford. — November 12th. General stores for the Tramways Department of the T.C. for a year; Tramway Offices, 7, Hall Ings (returnable deposit of £1 1s.).

Brighouse.—The Corporation has decided to obtain a new motor fire engine at a cost of £1,020.

Cape Colony.—Swellendam.—November 22nd. Tenders are invited by the municipality for a system of electric lighting. Tenderers must be prepared to undertake the carrying out of the scheme under concession for a given number of years. Tenders to be sent in before 3 p.m. on November 22nd, to F. A. Coldrey, town clerk.

Colwyn Bay.—November 12th. Switch panel, including switches and instruments, for the U.D.C. See "Official Notices" October 28th.

Dublin.—November 7th. General stores for the Dublin United Tramways Co., Ltd. See "Official Notices" October 14th.

France. — Tenders are invited by the Prefect of the Département du Calvados for the concession to build and work an electric or steam-driven tramway (1 metre gauge) from Poligny to Mézidon. Latest date of submission, February 1st next.

Invercargill (New Zealand). — January 9th, 1911. Power-house plant, cars, rails, overhead material, wires and cables, poles, &c., for an electric trolley system, also street-lighting plant, for the Corporation. See "Official Notices" October 14th.

Jerusalem. — November 13th. According to the *Quarterly Trade Journal* of the British Chamber of Commerce of Turkey, the municipality is to proceed shortly with electric tramway, lighting and telephone projects (separately or together). For further particulars see this column last week.

London.—L.C.C.—December 6th. Ash dust removing plant, for the East Greenwich generating station. See "Official Notices" October 28th.

Bethnal Green.—One thousand 100-volt, 22-c.p. metallic-filament lamps, for the Board of Guardians. See "Official Notices" October 28th.

Russia.—The municipality of Tiflis will shortly invite tenders for the erection of an electric generating station.

Southampton.—2,000 radiator lamps, for the Corporation Electricity Department. See "Official Notices" to-day.

Turkey.—Tenders are invited for the construction and working of electric tramways in Constantinople and suburbs. Each tender must be accompanied by a guarantee of 270,000 fr., and bear the inscription "Adjudication des Tramways urbains et suburbains à Constantinople et dans sa banlieue." Tenders must be sent to the Ministerie des Travaux Publics on or before November 10th. Local representation by branch houses or agents is necessary.—*Elektrotechnik und Maschinenbau.*

Wakefield.—November 12th. Coal (slack and smudge) for a year, for the Corporation Electricity Works, Calder Vale. The Electricity Works.

Walthamstow. — November 25th. One 1,000-kw. mixed-pressure turbine, with tandem generators of 500 kw. each, and surface condenser and pipework, for the U.D.C. See "Official Notices" to-day.

Warrington.—November 15th. Motors and transformers for a year, for the Corporation Electricity Department. See "Official Notices" October 21st.

November 18th.—Telegraph materials and carbons for a year, for the Cheshire Lines Committee (form 6). Stores Superintendent, Cheshire Lines, Warrington.

CLOSED.

Australia.—Sydney.—The City Council E.L. Committee last month recommended the acceptance of the tender of The British Insulated and Helsby Cables, Ltd., for the supply and laying of new underground cables for £15,007. These cables are required in view of contemplated improvements and extensions in connection with the installation during the next three or four years.

The *Australian Mining Standard* states that the Charlton Electric Light and Power Co. (V.) has ordered from Messrs. J. A. Newton and Co. cables, wires and insulators, at £342.

The Wagga Municipal Waterworks (N.S.W.) have ordered from Messrs. Saunders & Stuart suction gas plant and pump, at £3,060.

The same exchange states that for the P.M.G.'s Department in Queensland the Brisbane Electrical Co. (Thos. Tonks), Brisbane, are to supply the following:—

600 glass cells for Callaud battery, at 2s. 8d. each; 500 ditto, to take No. 1 Carporous pots, at 7d. each; 5,000 ditto, to take No. 2 ditto, at 5d. each; 1,200 ditto, for Daniell battery, at 1s. 6d. each; 10,000 corks and tubes for Meidinger battery, at 1½d. each; 4,000 porous cups for Daniell battery, at 4d. each.

Bawtry-Haxey.—The tender of Messrs. Henry Lovatt, Ltd., has been accepted for the construction of a light railway between Bawtry and Haxey. The length is 8 miles, and the cost will be about £30,000.

Canada. — According to the *Canadian Engineer*, the contract for the electrical machinery and producer gas plant for the Swift Current, Sask., has been placed with Messrs. Chapman and Walker, of Toronto, the electrical part at $16,650, and the producer plant at $25,000.

The Yorkton, Sask., contract for meters has gone to the Canadian Westinghouse Co., at $1,123; and that for transformers to the Packard Electric Co., Ltd., at $814.

The British Columbia Telephone Co. has sent an unusually large order for material, to cost over $500,000, to the Wire and Cable Co., of Montreal, and the Northern Electric Co., of the same city.

London.—L.C.C.—The tenders submitted for two turntables, for the second section of the central car-repair depôt, were as follows:—

Heenan & Froude, Ltd.	(accepted)	£444
Hurst, Nelson & Co., Ltd.		460
Dick, Kerr & Co., Ltd.		490
S. H. Heywood & Co., Ltd.		576
Whessoe Foundry Co., Ltd.		618

Chief officer's estimate, £460.

The Education Committee received the following tenders for the installation of electric light in the Sherington Road (Greenwich) School:—

London Electrical Engineering Co.		£253
E. Newbald & Co.	(accepted)	236
Johnson & Phillips, Ltd.		259
G. Weston & Sons, Ltd.		265
E. Lawrance & Sons, Ltd.		269

Stepney.—The following quotations were received for rubber cable:—

Baxter & Caunter	(accepted)	£57 10
W. T. Henley's Telegraph Works Co.		62 13
India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.		62 13

Luton.—The T.C. has accepted the tender of Messrs. Facer & Son for from 600 to 1,000 tons of South Leicester deep slack, for the electricity works, at 10s. 4d. per ton, or 9s. 4d. per ton if Corporation trucks are used.

Manchester.—The contract for the electric lighting of the Corporation main hydraulic-power station has been let to the firm of Messrs. A. S. Dewhurst & Co., Manchester.

Middlesex.—The County Council has accepted the tender of Messrs. Cox-Walker for moving and re-fixing an electric storage battery at the Napsbury Asylum, for £52 10s.

Sheffield.—The City Council, as announced last week, has accepted the tender of Messrs. Willans & Robinson for plant. They will supply a 5,500-KW. turbine at 1,000 R.P.M., with Dick, Kerr alternator. The Stirling Boiler Co. has received the contract for three water-tube boilers.

Stockport.—The T.C. has accepted the tender of Messrs. McClure & Whitfield for eight motors, at £293; and that of the Electrical Apparatus Co., Ltd., for eight starters, at £48.

Wigan.—The T.C. Water Committee received the following tenders for the installation of two electrically driven centrifugal pumps at the Boar's Head pumping station :—

Worthington Pump Co.	£439
Tangyes, Ltd.	414
Drysdale & Co., Ltd.	538
Holden & Brooke, Ltd.	468
Geo. Mills & Co., Ltd.	533
E. Scott & Mountain, Ltd.	425
Rees Roturbo Co., Ltd. (accepted)	339
Johnson Bros.	405
„ „ alternative	461
Tickle Bros.	417 (a) / 455 (b) / 437 (c) / 462 (d)
Pulsometer Engineering Co.	377
Corlett Electrical Engineering Co.	377
Isaac Storey & Sons, Ltd.	530

FORTHCOMING EVENTS.

National Electrical Manufacturers' Association (Incorporated).—Tuesday, November 8th. At 2.30 p.m. At Balfour House, Finsbury Pavement, London, E.C. Committee meeting.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, November 8th. At 7.30 p.m. At the University, Manchester. Paper on "Irregularities in the Rotating Field of the Polyphase Induction Motor," by Mr. C. F. Smith.

Institution of Civil Engineers.—Tuesday, November 8th. At 8 p.m. Paper on "The L.C.C. Holborn to Strand Improvement and Tramway Subway," by Mr. G. W. Humphreys.

Institution of Electrical Engineers (Glasgow Local Section).—Tuesday, November 8th. At 8 p.m. At 207, Bath Street, Glasgow. First meeting of the session. Inaugural address by Mr. S. Mavor.

Junior Institution of Engineers.—Wednesday, November 9th. At 7.30 p.m. At Caxton Hall, Westminster, S.W. Lecture on "The Law Relating to Engineering," by Mr. L. W. J. Costello. (Lecture III.)

Institution of Electrical Engineers (London).—Thursday, November 10th. At 8 p.m. At the Institution Building, Embankment, W.C. Inaugural address by Mr. S. Z. de Ferranti. Presentation of scholarships and premiums.

Physical Society.—Friday, November 11th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Paper on "The Supposed Propagation of Equatorial Magnetic Disturbances with Velocities of the Order of 100 Miles per Second," by Mr. C. Chree; and "Exhibition of a Brightness Photometer," by Mr. J. S. Dow.

Glasgow Technical College Scientific Society.—Saturday, November 12th. At 7.30 p.m. Paper on "Modern Lathes and Methods," by Mr. R. Lang.

NOTES.

Explosion at Bow Generating Station.—On Monday morning an explosion occurred at the power station of the Charing Cross, West End and City Electricity Supply Co., Ltd., at Marshgate Lane, Stratford. The circumstances were related at the inquest held on Wednesday into two deaths that occurred as the result of the explosion, the victims being Henry Hands, 30, a fitter, and J. W. Kingston, foreman engineer. Mr. R. Lane appeared for the company, and expressed their regret, offering to render every assistance. Mr. R. Shaxley represented the Home Office. According to the report in the *Daily Telegraph*, the Coroner stated that, so far as he could gather, a gang of men were employed in putting up some new pipes at the works, and they were testing them when a valve burst, in consequence of which two men were fatally scalded, whilst others were badly injured.

Ernest Coates, superintendent engineer of the company, said that he was inspecting the steam piping with Kingston in the engine room, in the basement. The pipes were being tested. The foreman tried the trap, and he thought it was free and nodded to a workman to open the valve gently, and then signalled to the workmen to stop. The workmen did so, and jumped down. Witness heard two cracks, and was enveloped in steam. He succeeded in making his escape, but the others were not so fortunate. It was a new line of piping they were connecting up, and it was only possible to do it when they were not generating energy. The work was carried out by Baxter and other men, under the supervision of the foreman. Baxter was the chief fitter on the works, and he was told that he need only make the range "alive" as far as the two 6-in. valves. To provide against water accumulating, one of the valves was slightly open. Steam was put on the main on Sunday afternoon, and it was left like that till the next morning.

Are there measures which might have been taken to prevent the explosion?—Yes, by having the steam trap on the line, but the line should have been made "alive" right away through. The foreman altered his instructions, and witness did not hear of it until after the accident.

David Baxter, a fitter, said he went with the deceased man Kingston and Mr. Coates to the store. He opened the valve, and he heard a "knocking." He told the foreman, and as soon as he did so, the report came. Witness got out uninjured, and then found that steam was shut off. Witness was instructed on Saturday to connect the new steam main, and did the work on Sunday. He looked at the valve on Sunday, and it was dripping enough to get rid of any condensation.

Dr. A. Troup, of Romford Road, Stratford, stated that he was called to the works, and found Kingston dead. Hands was lying in the basement unconscious, but he died within a few minutes. Death was due to shock from scalds.

The Coroner pointed out that the jury had to decide whether there was criminal negligence attaching to anybody, but judging from the evidence there seemed to be none.

A verdict of "Accidental death" was returned, the explosion being due, in the opinion of the jury, to water having been left in the pipe.

Athletic Club Notes.—The Ordnance Athletic Club (composed of employés of the Electric and Ordnance Accessories Co., Ltd.), held their first concert of the season on Friday evening last, at the King Edward VII Hotel, Birmingham. Mr. J. D. Morrison, secretary of the company, was in the chair, Mr. A. Willmott, assistant works manager, in the vice-chair, and they were supported by several heads of departments and officials of the club. The programme gave considerable pleasure to about 150 members and friends. The proceedings were wound up with a brief allusion by Mr. Morrison to the satisfactory nature of the club's progress. The membership now consists of some 600 men and boys, and the activities of the club were spread over all branches of athletics. The club played in the Birmingham Suburban Cricket League this summer, and finished third from the top, and in connection with this section, the chairman presented prizes to the best batsman and bowler of the season. In a short speech in which he expressed his interest in the football section, the chairman offered a prize to the player who scored the largest number of goals during this season. The officials of the company take great interest in the club, and are doing much to foster it.

A very successful dance, arranged by the Anchor Cable Athletic Club, took place at the Leigh Church Institute on Saturday evening last, October 29th. During the evening, the Cricket Team of the Club was presented with the Harrison Cup and the medals of the first division of the Leigh and District Cricket League. On the platform were Messrs. J. Bowyer, the works manager; A. Crooke, chairman of the League; W. B. Callender, vice-chairman; W. Sharples, League secretary, J. Urmston, the Anchor Club secretary, and members of the committee. Mr. Bowyer, who presided, complimented the Club on their successful season, remarking that it was very creditable after winning the Second Division cup and medals last year to have entered the Senior Division, and to have immediately carried off the cup for that section. He referred to the progress made by the club during the year, pointing out that a first-class cricket pitch had been laid, and at the moment the club were busy laying out a large bowling green for the older members. He trusted that the team would be as successful next season, when the handsome cup which lay before him would become the absolute property of the club. Mr. A. Crooke, before formally handing over the cup, apologised for the inability of the president, Mr. W. Harrison, J.P., to be present that evening. Mr. R. Higson, the captain of the team, in receiving the cup, expressed on behalf of the team his thanks to Mr. Harrison and the League committee. Mr. R. Smith's band provided the music, and Messrs. P. Wright and J. E. Murphy acted as M.C.'s for the dance.

How to Advertise Gas.—Our readers will remember that in our issue of October 21st, under the heading "Press Campaign," we drew attention to certain misrepresentations published regarding an installation of gas lighting in the meeting room of the Royal Society of Medical Officers of Health. Similar inspired communications appeared in the provincial Press, in even more glowing and audaciously mendacious terms. The alleged "triumph of gas," however, is a very empty victory—an achievement lacking even the elements of sportsmanship and honourable dealing. We have already pointed out that the electric light is still used by the Society; we now have strong grounds for the belief that the "ventilating" gas lamp installed in the meeting room (which is provided with an adequate system of artificial ventilation by electric fans) was either presented to the Society free of cost, or installed at a nominal charge, *for the sake of advertisement*. If we are wrong, the proof is easy, and we are prepared to publish that proof, in the shape of a duly authenticated statement on the part of the Royal Society of Medical Officers of Health, that the gas installation was purchased by the Society at its full price, and that no reduction was made on the score of "advertisement." Pending the receipt of such evidence, we refrain from further comment.

A Great Canal Project.—The construction of an international canal between the North Sea and the Mediterranean, *via* Holland, Germany, Switzerland and France, has been practically decided upon. The route will include portions of the Rhine, the Aar, the Swiss Lakes and the Rhone, with connecting canals where necessary. It is to be finished by 1915.

Radium in Austria.—A Radium Institute has recently been opened in Vienna and has at its disposal three grammes of radium from Joachimstal.

Apprentices on Strike.—The *Daily Telegraph* reports that another strike of apprentices has broken out at the engineering shops of Messrs. Clarke, Chapman & Co., Gateshead. The trouble now is due to the refusal of the lads to sign a form of indenture which the firm has submitted to them, the principal objection being to a clause which prohibits them joining a trade society except for sick benefits. In the notice accompanying the indenture it was stated that any apprentice who was not prepared to conform to the new arrangement could leave at once, and his clearance lines would be given to him. Some 200 lads left at once, and presumably their employment with the firm is terminated. Of the other 600 it is stated that a considerable proportion will refuse to sign the indenture, but are prepared to go on working until the firm takes some action.

Joule Medal.—The Manchester Education Committee has awarded the James Prescott Joule Medal, founded by Sir William Bailey (to commemorate the discovery of the mechanical equivalent of heat) to Mr. Phillip Kent, M.Sc.Tech., for a thesis on "Some Thermo-Dynamic Properties of Rubber."

Olympia Motor Show.—This Exhibition is to open to-day. It is said that 700 cars are on show, one-third of them being British made.

Appointment Vacant.—Canvasser for the Hampstead Borough Electricity Department (£150). See our advertisement pages in this issue.

Institution and Lecture Notes.—Association of Mining Electrical Engineers.—At a meeting of the Cumberland Branch on October 22nd, a discussion took place regarding the causes of certain accidents in coal mines, in the course of which Mr. J. G. Williams pointed out the advisability of wearing clogs (without irons) when working in connection with electrical apparatus down a pit. This precaution had been known to save a man's life, while his mate, who was wearing boots, was killed. The frequent return of a verdict of "Accidental Death" was commented upon, and it was urged that in many such cases contributory negligence on the part of the electrician should have been recorded in the verdict; in other cases, deaths from heart failure were ascribed to electric shock. The subject of examinations was then discussed, and resolutions were passed embodying the views of the Branch for transmission to the Council.

Institution of Electrical Engineers.—The opening meeting of the 1910-1911 session will be held on Thursday, November 10th, at 8 p.m., at the Institution Building, Victoria Embankment, W.C. The premiums awarded for papers read or published during last session will be presented, and Mr. S. Z. de Ferranti will deliver his presidential address.

Institution of Civil Engineers.—Several vacancies for scholarships under the Yarrow Educational Fund will occur in March, 1911, and the Council of the Institution is prepared to receive and consider applications therefor. Applications should be addressed to the Secretary of the Institution, Great George Street, Westminster, S.W. Mr. James C. Inglis, the late president, laid the foundation of the new building of the Institution at the corner of Great George Street and Princes Street on Tuesday last week.

I.E.E. (Manchester Section).—On Saturday this Section paid an official visit to the Machinery Exhibition in Manchester. The attendance at the Exhibition on Saturday totalled about 11,000, creating a record.

Institution of Electrical Engineers (Students' Section).—The opening meeting of this Section will take place on Wednesday, November 16th, in the Lecture Theatre of the Institution, Victoria Embankment, W.C., at 7.45 p.m. An address will be given by Mr. C. H. Wordingham, M.I.E.E. All students of electrical engineering are invited to attend this meeting, whether members of the Students' Section or not. Gentlemen desirous of attending who are not members are requested to send their names to the hon sec. (address below), not later than Tuesday, November 8th. The following is the programme for the 1910-11 Session. All the meetings will be held in the Institution Theatre at the time named above:—

November 16th, 1910.—Opening address by Mr. C. H. Wordingham, member.
November 30th.—J. C. Rennie, "Tramway Brakes and Brake Gear."
December 14th.—J. F. Shipley, "Progress in Arc Lamps."
January 19th, 1911.—P. R. Coursey, "Wireless Telegraphy, with special reference to 'short spark' methods."
February 1st.—H. Clark, "Telephony."
February 15th.—H. C. Mary, "Dry Core Lead-covered Telephone Cables."
March 15th.—R. C. Plowman, "Exhaust Steam Turbines."
April 12th.—J. M. Bloomfield, "Overhead Lines for Transmission of High-Tension Electrical Energy."
April 26th.—J. B. Sparks, "Electric Traction for Main Line Railways."
May 3rd.—Annual general meeting. A. E. E. Cheal, "Some New Zealand Electric Plants."

No programme of visits has been arranged, but suggestions with regard to visits are invited, and should be sent to the Hon. Sec., Mr. D. Betts, 3, Fordwych Road, London, N.W.

The Association of Engineers-in-Charge.—The annual ladies' night of this Association was held on Saturday last, October 29th, at the Abercorn Rooms, Great Eastern Hotel, under the chairmanship of Mr. A. E. Penn, the chairman of the Association. The visitors and guests to the number of 100 were received by Mr. and Mrs. Penn, and subsequently dined together. After dinner, the usual loyal toasts having been proposed and honoured, the chairman proposed the toast of "The Ladies," which was responded to by Mr. Alex. Ritchie, J.P. The only other toast was "Our Visitors," proposed by the hon. sec. of the Association, Mr. W. T. Pickett, and responded to by Mr. F. W. Bridges, the organiser of the recent Engineering Exhibition at Olympia. During the evening a capital musical programme was gone through, and a most enjoyable evening was spent, the whole proceedings reflecting great credit on the social committee of the Association.

Junior Institution of Engineers.—The annual general meeting of this Institution was held at the Royal United Service Institution, Whitehall, recently, the retiring chairman, Mr. Geo. T. Bullock, presiding, and from the Council's report which was presented, it was shown that the work of this Society still continued to flourish. The total membership at the end of the session was 1,089; nine ordinary meetings had been held, at which the average attendance was 114; a large number of visits had been paid to engineering works, and special reference was made to the summer meeting in Ireland, when works in and around Dublin and Belfast were seen. Sir J. J. Thomson, F.R.S., has accepted the position of President for the ensuing year. Mr. J. Wylie Nisbet was elected chairman.

University College.—Prof. J. A. Fleming, F.R.S., will deliver a course of advanced lectures on "The Theory and Practice of Electrical Measurements, with Special Reference to Telegraphy and Telephony," at University College, on Wednesday afternoons at 5 p.m., beginning January 11th, 1911. The course is designed to meet the needs of post-graduate students, teachers, telegraph, telephone and electrical engineers generally possessing some knowledge of the subject of electrical measurements, but desiring to make a further study of the advanced theory and practice. As only a limited number of students can be admitted, early application should be made. Full particulars may be obtained from the Secretary of the College.

Concrete Institute.—On Thursday last week a paper was read by Mr. A. C. Davis, F.C.S., on "The Manufacture of Portland Cement," in the course of which the author stated that the intermittent process was becoming obsolete, the continuous process taking its place. The latter, it may be noted, is well adapted for electrical driving, and has practically revolutionised the industry.

Institution of Municipal Engineers.—The Council has decided to award two premiums—one of which has been presented by the president—annually for the best original papers read by members or students before meetings of the Institution.

On Friday last a paper was read before the Arc Works Engineering Society by Mr. H. M. Hobart, M.Inst.C.E., on "Electric Railway Cost Estimating."

Association of Teachers in Technical Institutions.—The annual meeting of the above Association will be held at the Northern Polytechnic, Holloway Road, to-morrow, November 5th, at 3 p.m. The president of the Association will move the adoption of the annual report. This includes an account of the work of the Council during the past year in such matters as registration, superannuation, Royal Commission on London University, policy on reforms concerning technical education, legal matters, &c. The results of the recent elections for officers for the coming year will be announced.

Humming of A.C. Motor.—A correspondent fixed a 1-H.P. A.C. motor a short time ago, for organ blowing, in a small house built on to the main outside wall of a church. The "hum" usually associated with an alternating motor is objectionable in the church and, so far, he has been unable to stop it. If any of our readers can suggest a way out of this, short of isolating the motor house, he will appreciate the suggestion.

Thermal Treatment with High-Frequency Currents.—At the third Congress of Physiotherapy, held at Paris, Dr. M. Magelschmidt reported on the thermal effects of high-frequency currents on the tissues of the body. By this means it is possible to cause a very marked rise of temperature, and to coagulate the blood so as to facilitate surgical operations without loss of blood, besides other advantages.

Wireless Telegraphy in Australian Steamers.—According to the *Times* of yesterday, the Aberdeen line "have concluded arrangements with the Marconi Co. for placing the latest type of wireless installation upon the steamers *Miltiades*, *Marathon* and *Moravian*. A similar plant will be provided in the new steamers *Themistocles* and *Demosthenes*, now nearing completion at Belfast, and all five steamers will be fitted with a submarine signalling apparatus."

The Post Office New Power Station.—On Thursday next the new central power station of the General Post Office, in Upper Ground Street, Blackfriars Bridge, S.E., also the sub-stations in the G.P.O. Buildings, St. Martin's-le-Grand, are to be inspected by a party of Press and other visitors, by invitation of the Postmaster-General.

Will.—Mr. Thomas Hurley, electrical engineer, of Messrs. Gent & Hurley, Leicester, who died on July 20th, aged 69 years, left estate of the gross value of £8,533, with net personality £6,633.

Lightning Stroke.—On Wednesday the Waterloo Chemical Works, Newcastle-under-Lyme, were struck by lightning; three flashes struck the conductor on the chimney, which is 152 ft. high, and passed to the electrical installation, fusing the wires and setting fire to the woodwork. The flames were put out with a hand extinguisher.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Lancaster Town Council has appointed Mr. G. C. Milnes borough electrical engineer, to succeed Mr. W. A. Tester, who, as already stated, is proceeding to South Africa.

The Rugby U.D.C. has increased the salary of Mr. T. S. Shenton, manager of the electricity undertaking, from £180 to £200 per annum, as from October 1st.

The Shoreditch Electricity Committee received 170 applications for the position of mechanical engineer-in-charge at Whiston Street generating station. Eighteen applications were considered in detail, and seven candidates were interviewed. Mr. A. Barbour, of Great Crosby, was duly appointed.

Mr. W. R. Watt, of the Aberdeen Corporation electricity department, having secured an appointment on the staff of the Electric and Ordnance Co., Ltd., of Birmingham, the staff of the department marked the occasion by entertaining him to supper at the Imperial Hotel. Mr. Downie presided, and expressed regret at Mr. Watt's departure, after seven years with them as a general favourite. Mr. Watt, in responding, thanked the staff for the kit bag presented by Mr. Bell, and for their expressions of goodwill.

The Hounslow U.D.C. has decided to make the shift engineers of the undertaking monthly servants, at the following salaries:—First year's service, £5 10s. per month; second year, £6 10s.; third year, £7 10s.; fourth year, £8 10s.

The Stoke-on-Trent Electricity Committee recently referred the claims for compensation from Mr. Ashton Bremner and Mr. P. J. S. Tiddeman, late borough electrical engineers, of Burslem and Stoke respectively, in consequence of the abolition of such offices, to the Finance Committee.

Tramway Officials.—The Bournemouth Tramways clerical staff has presented a marble clock to Mr. F. Collins on the occasion of his marriage.

Mr. F. E. Saunders, late tramways manager at Maidstone, has been presented with a gold watch by his late colleagues and the various heads of the Corporation departments.

Consequent upon the resignation of Mr. J. H. Rider, the electrical engineer to the L.C.C. tramways department, the Highways Committee has made certain recommendations as to the re-arrangements in the staff. The Committee reports as follows:—

"In dealing with this matter we have also had regard to the great development of the tramway system which had taken place in recent years. As the department is at present organised there is an official in charge under the chief officer of tramways of each section of the department, but there is no one in the position of deputy to the chief officer to take charge of the whole department in the chief officer's absence, and to relieve the chief officer of any of the vast amount of detail work which yet must be performed by an officer in a place of high responsibility. We are, therefore, of opinion that the time has arrived when a deputy chief officer should be appointed in the department. Mr. J. K. Bruce, the present traffic manager, is well qualified by his abilities and general experience of tramway work to fill this position, and we suggest that he should be promoted to be deputy chief officer at his present salary of £950 a year, rising on April 1st, 1911, to £1,000 a year. To fill the vacancy thus created in the traffic section we suggest that an assistant should be appointed, at a salary of £600 a year, to take charge of the traffic work. It is proposed that applications for this appointment shall be invited by public advertisement.

"As regards the electrical work of the department, we think, now the generating station is practically completed and the electrical equipment of the present lines is well advanced, that the requirements of this branch of the tramways work will be met by placing an assistant in charge of the electrical section at a salary of £800 a year. There is at present an assistant electrical engineer (Mr. J. Shepherd) who is in receipt of a salary of £600 a year, and, having carefully considered his qualifications, we have decided to recommend that he should fill the new position at the increased salary.

"Having regard to the responsible nature of his work, we think that the salary of Mr. W. P. Farquharson, general assistant, should be increased from £500 to £600 a year."

Existing arrangements.		*Proposed arrangements.*	
Electrical engineer	£1,200	Deputy chief officer	£950
Traffic manager	950	Electrical assistant	800
Assistant electrical engineer..	600	General assistant	600
General assistant	500	Traffic assistant .. .. ,,	600
	£3,250		£2,950

A saving of £300 a year will be effected by the suggested re-organisation. It is recommended:—

(*a*) That the positions of electrical engineer, traffic manager and assistant electrical engineer in the tramways department be abolished.

(*b*) That a deputy chief officer of tramways be appointed in the tramways department.

(*c*) That Mr. J. K. Bruce be promoted to be deputy chief officer of tramways in the tramways department at his present salary.

(*d*) That an electrical assistant be appointed in the tramways department at a salary of £800 a year.

(*e*) That Mr. J. Shepherd be promoted to be electrical assistant in the tramways department, and that his salary be increased from £600 to £800 a year.

(*f*) That the salary of Mr. W. P. Farquharson, general assistant in the tramways department, be increased from £500 to £600 a year.

(*g*) That a traffic assistant be appointed in the tramways department at a salary of £600 a year. The promotions are to take effect as from November 1st, 1910.

General.—The marriage took place at Alltwen, on October 26th, of Mr. David Owen Williams, electrical engineer, of Clydach and Morriston, and Miss Annie Anthony, of Penywern, Alltwen.

Mr. W. A. Turnbull, chief assistant electrical engineer to the York Corporation Electricity Department, terminated his services on Friday last, to take up the position of residential electrical engineer at the Stoke-on-Trent Electricity Works. Mr. Turnbull has always been held in high esteem by his fellow-workers at York, and Mr. Hame, the city electrical engineer, on behalf of the staff and workmen, presented him with a silver cigarette case.

Mr. William Leonard, the chief electrical engineer of the S.E. & C. Railway, retiring on the 31st ult. Mr. R. H. Burnham, his assistant, has been appointed telegraph superintendent from the same date. Mr. Leonard succeeded the late Mr. C. V. Walker in January, 1883.

Mr. F. C. Winkworth, chief engineer at the Waldorf Hotel, London, since 1908, was last Saturday presented by the management and staff with a chiming clock as a token of esteem on the occasion of his leaving to take up a similar position with the Royal Automobile Club, Pall Mall. Mr. Winkworth was at one time on the outside staff of Messrs. Willans & Robinson, in which capacity he came into touch with many central station men.

Mr. J. S. Cunnington, chief engineer and manager to Messrs. Cunnington & Harris, Ltd., who is severing his connection with that firm, asks that communications be addressed to him in future, c/o Fuller Manufacturing Co, Norfolk House, Cannon Street, E.C.

Mr. A. G. Seton-Chisholme, of Messrs. Siemens Bros., was married on Friday last at St. Margaret's, Whalley Range, Manchester, to Mrs. Ella Smith. The presents were numerous, the bridegroom being popular among the electrical fraternity in that part of the country.

Mr. R. W. Weightman, Chief Engineer of Telegraphs, Natal, retired on pension at the end of October, when several changes were to take place in the department. Mr. Norman Harrison, who was Mr. Weightman's assistant, has been appointed Chief Engineer of the Union Telegraphs.

Mr. Wm. H. Booth returned on Monday by the *Atrato* from his visit to Venezuela and the West Indies. Pending further arrangements, all communications should be addressed to him at 19, Chatsworth Road, West Norwood.

Mr. G. Hooghwinkel, of Messrs. Hooghwinkel, Anthony Brown and Partners, has returned from Mexico, where his firm has opened a branch office at Calle de Cadena, No. 2, Mexico City, under the superintendence of M. Victor Braschi.

Mr. A. C. Kelly, A.M.I.C.E., who went to Argentina in 1909 to report on the suburban electrification of the Buenos Ayres and Pacific Railway Co., has been appointed chief electrical engineer to that company, with headquarters at Buenos Ayres.

Mr. E. J. Fox, who has been so closely associated with Messrs. Willans & Robinson, Ltd., of Rugby, for some nine years, is leaving, at the end of the year, to take up a better appointment with Messrs. Stewart & Lloyds, with London as his headquarters. We wish Mr. Fox every success in his new sphere of operations.

On the 24th ult. Mr. W. B. Adams, A.M.I.E.E., son of Mr. W. Adams (Adams Watkin Co., Ltd.), was married at Seville, Spain, to Miss A. D. Beare, of "Sherrington," Norbury. Mr. Adams was formerly at Croydon and Marylebone electricity works, and now holds an appointment with the Rio Tinto Copper Co.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Cleveland and Durham Electric Power, Ltd. (89,539).—Issue on October 7th of £7,000 second debentures, part of a series to secure £150,000, particulars of which have already been filed.

Imperial Tramways Co., Ltd. (58,981).—Return dated June 10th, filed October 3rd. Capital £400,000 in 20,000 pref. and 20,000 ordinary shares of £10 each. All shares taken up; £100,000 paid on 10,000 pref. shares. £300,000 considered as paid on 10,000 pref. and 20,000 ordinary. Mortgages and charges: £300,000.

British Aluminium Co., Ltd. (108,758).—Trust deed dated October 11th, 1910, to secure £750,000, and a premium of 10 per cent. thereon, charged on the company's undertaking and property, present and future, including uncalled capital (subject to £800,000 prior lien debentures, part of an authorised issue of (£1,000,000). Trustees: Trustees, Executors and Securities Insurance Corporation, Ltd., Winchester House, E.C.

British Aluminium Co., Ltd. (108,758).—Particulars of £800,000 debentures and a premium of 10 per cent. thereon, created April 15th, and secured by trust deed dated October 11th, 1910, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: Certain freehold and leasehold property, 75,000 fully-paid £1 shares in the Loch Leven Water and Electric Power Co. and the right to a first mortgage on the undertaking of that company, with the payment to the company of £240,000 and interest, and the company's undertaking and property, present and future, including uncalled capital. Trustees: the Trustees, Executors and Securities Insurance Corporation, Ltd.

Newquay Electric Light and Power Co., Ltd. (85,451).—Particulars of £1,500 second mortgage debentures, created September 18th, 1910, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

British Thomson-Houston Co., Ltd. (47,982).—Return dated October 12th, filed October 21st, 1910. Capital £800,000 in 40,000 ordinary and 40,000 preference shares of £10 each. All shares taken up. £10 per share called up on 22,531 ordinary and 40,000 4 per cent. preference. £726,810 paid. £74,690 considered as paid on 7,469 shares. Mortgages and charges: £201,079

Dick, Kerr & Co., Ltd. (63,407).—Return dated October 13th, filed on October 20th, 1910. Capital £630,000 in 350,000 preference and 900,000 ordinary shares of £1 each. 305,000 preference and 260,000 ordinary taken up. £1 per share called up on 265,000 preference. £265,000 paid. £300,000 considered as paid on 40,000 preference and 60,000 ordinary. Mortgages and charges: £259,430.

G. Pearson & Sons, Ltd. (106,908).—First mortgage debenture dated October 14th, 1910, to secure £300, charged on 154, Abbott Road, Poplar, and company's other assets, present and future, including uncalled capital. Holder: N. R. Pearson, Westholme, The Cliffs, Westcliffe-on-Sea.

Larne Electric Light Works, Ltd. (46,962).—Particulars of £3,000 debentures, created October 16th, 1910, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,200. Property charged: The company's undertaking and property, present and future. No trustees.

Charles Joyner & Co., Ltd.—A memorandum of satisfaction in full on September 30th, 1910, of debentures dated May 16th, 1900, securing £2,000, has been filed.

British Radio-Telegraph and Telephone Co., Ltd. (104,024).—Particulars of £5,000 debentures, created September 27th, and secured by trust deed dated September 28th, 1910, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1901, the whole amount being now issued. Property charged: Certain patents and the company's undertaking and property, except uncalled capital. Trustees: H. B. Taylor and M. C. Matthews.

Maxim Lamp Works, Ltd.—Assignment dated September 29th, 1910, to secure £1,060 13s., charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Barclay and Co., Ltd., 54, Lombard Street, E.C.

Patent Conveyor Co., Ltd. (85,803).—Debenture dated October 1st, 1910, to secure £800, charged on the company's undertaking and property, including uncalled capital. Holder: Mrs. V. Harrop, Junction House, Esholt, Yorks.

THE IDEAL CITY.

THE references made by various speakers at the recent conference on town planning, held under the auspices of the Royal Institute of British Architects, show the importance which is attached to the utilisation of electricity in the evolution of the ideal city, although, as was also pointed out, it was the absence of modern convenience which gave opportunity for the beautiful planning of ancient cities. One of the most interesting papers read at the conference was that prepared by Mr. W. H. McLean, the municipal engineer of Khartoum, the illustrations accompanying the paper showing how, in a few years, on the site of what was a pest-house, there has arisen in the centre of Africa a modern city, conveniently planned and equipped with electric light. M. E. Hénard (architect of the City of Paris) drew an imaginary picture of the city of the future, in which he advocated the construction of the pavement and carriageway at a sufficient height to allow underneath space enough to contain all the installations needed for the service of the houses in the street.

Immediately below the bridge roadway would be suspended the whole system of pipes required for vacuum cleaning, supply of compressed air, river water, sterilised pure water, petrol and liquid air; conveyance of letters; supply of pure air, &c.; and then all the systems of electric cables (telegraph, telephone, light, energy, high-frequency currents, &c.). Underneath the said systems, which would all be easily accessible and controllable, a space of 25 m. in height would be left, absolutely open to the old ground-level. Four railway lines would then be laid, 1 m. apart, upon which would run trains of small trucks, to remove all rubbish and refuse, as and when required, to convey all heavy and cumbersome materials, and to clear the rubbish from building and repairing yards. The two central lines would serve for long-distance transport, whilst the two lateral lines would be used for light trains; they would be connected by turning platforms with the private lines leading into each house. This underground street would be permanently lit by incandescent lamps and glass plates on a level with the pavement. The ventilation produced by electric fans would be promoted by high chimneys located at given intervals through the party walls between the houses.

Mr. D. Burnham, of Chicago, looked forward to the time when all electric energy would be generated at the pit's mouth. Herr Dr. Stubben illustrated his scheme for the construction a new town to be called St. Anne, on the banks of the Schelde, opposite Antwerp, showing two tunnels under the Schelde to connect the new town with the metropolis, through which tramways would run. Mr. Arthur Crow, the district surveyor for Whitechapel, advocated for London a series of radiating tubes and sub-surface railways from the City, having stations situated at distances of 1 and 2 miles respectively from the central station. The termini of these lines, falling on the circumference of a circle of some 28 miles in diameter, would constitute the centres of 10 new areas, forming in due time cities of health. Mr. G. L. Pepler spoke in favour of a great ring road round London, with an electric railway.

CITY NOTES.

Edison & Swan United Electric Light Co., Ltd.

THE directors' report for the year ended June 30th, 1910, states that the net revenue account shows that £23,234 has been brought forward from profit and loss account. Interest on debenture stock has absorbed £15,702; £5,500 has been set aside as depreciation on freehold and leasehold property, plant and tools; £4,000 has been applied in writing down values of stocks, and £1,216 has been reserved on account of bad and doubtful debts. The result, as shown in the net revenue account, is a debit balance of £3,184, which must be deducted from £10,027 brought forward from the previous year, thus leaving a sum of £6,843, which the directors propose to carry forward. Cost of establishing the business, goodwill, &c., £390,432, has been brought forward at the figure standing in the last balance-sheet. The freehold and leasehold property and plant have also been brought forward at the value stated in the last balance-sheet, with the addition of the amount expended to June, 30th, 1910, less depreciation charged in net revenue account. The shares of the Altrincham Electric Supply, Ltd., have been taken at par, as in previous years. This concern continues to be satisfactory, and has paid a dividend on its shares of 7 per cent. for the year ended December 31st, 1909. Its indebtedness to this company has been reduced during the year by £275. There has been expended on capital during the year ending June 30th, 1910, £5,931, mainly on account of additions to buildings and plant in connection with the manufacture of metal-filament lamps. The directors regret that the year's trading has not been more satisfactory. This is due mainly to the high costs of production of metal-filament lamps, which prevailed during the earlier part of the year. The directors are glad, however, to be able to state that these costs have been largely reduced during the later part of the year under review, and they are of opinion that the current year should show a marked improvement as a consequence, judging from the results produced during the months which have elapsed since the close of the financial year, which have been of a satisfactory character. The directors have to report that Sir J. W. Swan, F.R.S., resigned his seat on the board on January last, in consequence of ill-health.

Brown, Boveri & Co.—At an extraordinary meeting of Brown, Boveri & Co. A.G. (Switzerland), held recently, the President alluded to the agreement come to with the Elektricitäts-Gesellschaft Alioth, of Basel, and the Isaria Zählerwerk, of Munich, for incorporation, and the increase of the share capital from 20 to 28 million francs. He remarked that the objects of the consolidation were to do away with competition in each of the countries and to increase production. The agreement with the Alioth Co. would create for Brown, Boveri at home and abroad a number of valuable connections, and that with the Isaria Werk, especially in South Germany, where hitherto their operations had been restricted solely to machinery, would ensure to them an opening for the extension of business in the mass of accessory electrical articles which they manufactured. The exchange of Alioth shares had already surpassed the requirement. The new shares to the extent of 175 millions not affected by the two transactions would be taken over by a bank consortium. Both propositions were passed unanimously without discussion. As new members of the directorate, were elected Messrs. A. Sarasin, Simonius-Blumer, L. Dubois, G. Bohner and Dr. E. Bloch.—*E.T.Z.*

Western Telegraph Co., Ltd.—The directors' report for the half-year ended June 30th, 1910, states that the revenue for this period amounted to £402,433, and the working expenses to £148,392. After providing £16,233 for debenture stock interest, and £7,774 for income-tax, there remains a balance of £230,034; to this is added £6,009 brought forward from December 31st last, making a total of £236,043, out of which sum the expenses in connection with further issue of 4 per cent. debenture stock, amounting to £358 have been defrayed. A quarterly interim dividend, amounting to £31,189, has been paid, £135,000 transferred to the general reserve fund, and £10,000 to the land and buildings depreciation fund. The directors now recommend the declaration of a final dividend of 3s. per share, making, with the interim dividends, a total dividend of 6 per cent. for the year, also the payment of a bonus of 2s. per share, both free of income-tax, which, together, will amount to £51,982, leaving a balance of £7,513 to be carried forward. The dividend and bonus will be paid on November 10th.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—In their report for the half-year ended June 30th last, the directors state that the gross receipts amounted to £344,960, against £290,931 for the corresponding half-year of 1909. The working expenses, including £22,789 for maintenance of cables, absorb £152,407, against £156,976 for the corresponding period of 1909, leaving a balance of £192,553. From this is deducted £2,654 for income-tax payable in England, £3,378 for expenses attending a severe cyclone at the Cocos station, £25 donation to Paris floods relief fund, and £15,048 for interest on debenture stock, leaving £171,447 as the net profit for the half-year. After adding £26,315 brought forward from the previous half-year, there is an available balance of £197,763. Two quarterly interim dividends of 1½ per cent. each, amounting to £75,000, have been paid for the half-year, leaving a balance of £122,763, of which £50,000 has been transferred to the general reserve fund, and the balance of £72,763 is carried forward. The general reserve fund has been debited with £30,000 as a further provision on account of investment fluctuations making a total provision against depreciation of £150,000.

Auckland Electric Tramways Co., Ltd.

THE meeting of this company was held on Monday at the Electrical Federation Offices, Kingsway, W.C., under the chairmanship of Mr. C. G. Tegetmeier.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 716), the chairman said the report and accounts were for the six months ending June 30th, as, at the last meeting, it was decided to close the company's financial year on June 30th instead of December 31st. The result of the operations of the company for the six months under review afforded very gratifying evidence of the continued expansion and progress of the business. They had carried over a million more passengers and their traffic receipts were £6,463 more than in the six months of last year. He noticed a statement the other day that the splendidly organised tramways in the City of Glasgow were exceptional in carrying the population 222 times in the course of the year. Taking the population of Auckland and the districts served by their lines at 100,000, which was a liberal estimate, it would be seen that they were carrying the population more than 300 times in the course of the year, and he might add that it was not an unusual thing for them to carry a number of passengers considerably greater than the whole of the population in one day. With the exception of the short extension in the Grey Tyne district, the road mileage worked had been the same, but to meet the increased public requirements they had run a considerably increased service, and their working expenses were necessarily higher, although proportionately to the increased car-mileage run they showed a satisfactory decrease, the ratio of expenses to receipts having gone down from 62 per cent. to 59 per cent. As their books were not balanced on June 30th of last year, it was not possible to make an exact comparison, but approximately their net working profit showed an improvement of about £4,000 over the first six months of the previous year. At the last meeting he referred in considerable detail to the various figures in the accounts. The changes which had taken place in the six months were few. Including the amount brought forward, and after placing £7,500 to depreciation account as provision for prospective renewals and reconstruction, they had a balance available for distribution of £24,073. The dividend on the preference shares for the half-year required £1,500, and they proposed to place £6,000 to the reserve, which would bring it up to £50,000, and to pay a dividend on the ordinary shares for the half-year at the rate of 6 per cent., which was the same rate as last year. This would leave £6,073 to be carried forward, or £2,528 more than they brought into the accounts. One item in the profit and loss account required some explanation, which was that of £827, expenses in connection with the brakes inquiry. They might remember that over two years ago the New Zealand Government appointed a Royal Commission to inquire into the question of brakes on the company's cars, and consequent upon the report of that Commission they obtained the sanction of the New Zealand Public Works Department to equip two of the cars with the latest improved air brake, which they were advised and considered would be the most suitable for the conditions they had to meet in Auckland. Of course the company, no less than the Government, were anxious that the most suitable and efficient type of brake should be adopted, and from their experience extending over some months this brake was perfectly satisfactory, not only to the company's responsible officers but also to the men in charge of the cars, who were directly concerned in the efficiency and reliability of the brake they had to work. They were desirous of fitting the whole of their cars with a similar type of brake, which would cost approximately about £12,000; but the Public Works Department were not prepared to give the necessary sanction, and as the result of some controversy the New Zealand Government appointed a second Royal Commission to again investigate the matter. The Commission took very exhaustive evidence in the principal cities of New Zealand where electric tramways were operated, and in their report issued in June they concurred in the adoption by the company of the type of brake which the company had for some time been willing and anxious to install. They had not yet had the approval of the Public Works Department, but as soon as this was received the work of installing the air brake on all their cars would be taken in hand and completed with all dispatch. As being to some extent connected with this matter, he might refer to the Tramways Amendment Bill which had recently been introduced by the New Zealand Government into the House of Parliament, and the effect of which, if it passed, would be to centralise in the Government a good many of the powers at present possessed by the local authorities with regard to the tramways in their respective districts. In the other principal cities of New Zealand the tramways were owned and worked by the local authorities under the provisions of Orders in Council obtained by them, and the proposed modification of the powers they now possessed appeared to be raising considerable opposition. In their case they worked under an Order in Council granted to the local authority and delegated to the company on specified conditions. They were on friendly terms with the Auckland City Council and the various other local authorities in the districts in which they operated. It was true that the City Council had been very insistent on their carrying out to the full the obligations imposed on them, but they had no complaint to make on this score, although, perhaps, sometimes they thought the local authority did not make sufficient allowance for the difficulties they had had to meet. Still, they recognised the City Council and the other local authorities as the guardians of the public interest, with full and complete knowledge of the local conditions and requirements, and they would be sorry if the effect of the new legislation was to alter the nature of their relations with them. During the six months their capital expenditure had amounted to £15,233, and the bulk of this expenditure had been in connection with the extension of the power house plant and distributing system which they commenced last year. The work of installing the new plant, and the very extensive alterations and additions to the power house which it involved, had taken longer to complete than was anticipated, and had proved a very difficult and complicated work to carry out, and at the same time to meet the demands upon the power house of continually increasing traffics. The work was now practically complete, and with the new plant and the eight new cars which would shortly be available, their position would be very much strengthened in dealing with the growing traffics. In the last three and a half years their capital expenditure on extension of lines, rolling stock and the generating station had amounted to nearly £200,000, and their total capital expenditure was now £762,155. They had further considerable expenditure in view. The progress of Auckland in the last three or four years in everything which constituted material prosperity had been very marked, and there were grounds for the confident anticipation that there was a period of still greater expansion and prosperity ahead. Public and private enterprise involving an expenditure of several millions of money were being carried out or projected, and the municipal development of the city was in many respects on a scale to meet the needs of a city of 250,000 people, and he did not think it was taking an unduly sanguine view to anticipate that this number would be reached before the remaining 22 years of their concession had run off. With the indications before them of the present prosperity and the prospective growth of Auckland, they thought it well to provide in advance for what would certainly be an increased demand for travelling facilities. Last year they took steps to increase their generating plant by the addition of a 600-KW. set, or an increase of nearly 30 per cent. Hardly had this become effective, however, than they again considered the question of further plant, and they had decided to install another 1,000-KW. set, or a still further increase of 40 per cent. on their present capacity. This would bring their total generating plant to a capacity of 3,750 KW., equivalent, approximately, to 6,000 indicated H.P., and so, whatever might be the development of Auckland in the near future, this would give them an ample margin for at least several years to come. They were also putting in hand the construction of 16 more cars, which would bring the total number of their passenger cars up to 116. In conclusion, the chairman referred in warm terms to the admirable work of Messrs. O. M. Hansen and C. Rhodes, the local directors; Mr. J. J. Walklate, the general manager and engineer, and the local staff.

MR. C. SHIRREFF HILTON seconded the motion, which was carried without discussion.

On the motion of MR. E. GARCKE, a hearty vote of thanks was passed to the board.

Official Announcements re Companies.

THE following companies will, unless cause is shown to the contrary, be struck off the register within three months, and will accordingly be dissolved:—

Anglo-Spanish Electricity Co., Ltd.
Cassel Self-Regulating Water Wheels, Ltd.
Chemical and Electrolytic Syndicate, Ltd.
Cycle Electric Lamp Co., Ltd.
Electrical Castings and Engineering Co., Ltd.
Elmores Trust, Ltd.
Greville Electric Inventions, Ltd.
Harwich Electric Lighting and Tramways Co., Ltd.
Loughborough and District Electric Traction Syndicate, Ltd.
Marvin Sandycroft Electric Drill Syndicate, Ltd.
Mexican Gas and Electric Light Co., Ltd.
North Wales and District Light Railway and Electric Power Syndicate, Ltd.
Pearson Fire Alarm Syndicate (Railways, Docks and Shipping), Ltd.
Peru Telephone Co., Ltd.
South American Electric Co., Ltd.
Thomson-Davis Telephone System, Ltd.
Traction Co. of the United Kingdom, Ltd.
Tramway Traction Co. Ltd.
Universal Lighting Syndicate, Ltd.

Eastern Telegraph Co., Ltd.—The directors' report for the six months ended June 30th, 1910, shows that the revenue for the period amounted to £664,573, from which are deducted £223,418 for the ordinary expenses, and £60,376 for expenditure relating to maintenance of cables, sundry differences in exchange, and income-tax payable abroad, leaving a balance of £380,749, to which is added £34,453 brought from the preceding account, making a total available balance of £415,202. After providing for income-tax payable in England, interest on mortgage debenture stock, and for two quarterly dividends on the preference stock, which in all absorb £80,611, there remains a balance of £334,590, out of which the directors have placed £175,000 to the general reserve fund, and have allocated £100,000 to meet the two interim dividends of 1¼ per cent. each on the ordinary stock, the balance of £59,590 being carried forward.

Stock Exchange Notices.—The Committee has appointed Wednesday, November 16th, to be a special settling day in United River Plate Telephone Co., Ltd.; further issue of 40,000 ordinary shares of £5 each, £3 10s. paid (Nos. 150,001 to 190,000). The same securities are also to be officially quoted.

West India and Panama Telegraph Co., Ltd.—The directors announce a dividend of 15s. per share on the second preference shares (9s. balance accrued to December, 1909, and 6s. for the half-year ended June, 1910), and 1s. per share on the ordinary shares.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	Oct. 26	2,536	+ 78	21	31,750	+ 43	..	..
Ayr	„ 29	385	+ 10	24	9,268	+ 353	8	..
Bath	„ 29	1,477	+ 42	43	35,707	+ 1,931	..	..
Belfast	„ 23	8,355	+ 831	30	123,250	+ 6,649	37	..
Birkenhead	„ 16	2,042	— 14	28	31,790	+ 708	13·68	..
Birmingham Corp.	„ 22	13,979	+ 238	29	198,864	+ 3,164	56·7	..
Blackburn	„ 26	2,043	+ 183	30½	33,604	— 1,081	14·12	·12
†Blackpool Corp.	„ 27	552	+ 227	..	14,198	+ 183	..	..
Blackpool-Fleetw'd	„ 29	734	— 408	17	21,522	+ 640	..	..
Bolton	„ 30	4,569	+ 125	31	73,291	+ 206	26	..
Bournemouth	„ 26	2,992	+ 133	29½	58,698	+ 4,869	21·9	..
Bradford	„ 22	10,121	+ 213	30	152,911	+ 5,770	54·8	..
Brighton	„ 30	1,806	+ 42	33½	32,663	+ 282	9·5	..
Bristol	„ 28	11,199	+ 300	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	„ 21	459	— 9	42	9,251	+ 52	3·65	..
Barnsley	„ 21	351	..	42	7,387	+ 190	..	..
Barrow	„ 21	478	..	42	11,406	+ 1,537	5·37	..
Cavehill	„ 21	159	+ 24	42	3,959	+ 194	..	..
Devonport	„ 21	884	+ 138	42	18,094	+ 2,567	8·85	..
Gateshead	„ 21	2,096	+ 22	42	41,756	— 65	11·25	..
Gravesend	„ 21	406	— 31	42	8,834	— 121	6·5	..
Greenock	„ 21	1,186	..	42	26,635	+ 3,037	7·25	..
Hartlepool	„ 21	462	— 20	42	10,647	+ 642	6·72	..
Kidderminster	„ 21	192	— 2	42	4,789	+ 147	..	..
‡Leamington	„ 21	428	+ 35	42	7,296	— 272	..	..
Merthyr	„ 21	409	+ 13	42	8,780	— 185	2·9	..
Metropolitan	„ 21	15,542	+2,207	42	317,969	+54,829	22	..
Middleton	„ 21	613	— 38	42	13,475	— 829	8·5	..
Mid. Joint Com'tee	„ 21	11,958	— 107	42	244,783	+ 3,274	..	..
Oldham—Ashton	„ 21	1,114	— 63	42	23,500	— 211	9·13	..
Peterborough	„ 21	224	— 13	42	5,003	— 69	5·31	..
Potteries	„ 21	3,950	— 1	42	74,516	— 657	29	..
Rothesay	„ 21	124	+ 22	42	9,753	+ 156	2·75	..
Southport	„ 21	519	+ 3	42	12,686	+ 228	8·17	..
S. Metropolitan	„ 21	1,613	— 37	42	35,389	+ 1,273	..	..
Swansea	„ 21	2,194	+ 177	42	45,982	+ 4,816	12·5	..
Tynemouth	„ 21	377	— 20	42	11,804	+ 540	3·75	..
Weston-s-Mare	„ 21	100	— 9	42	6,920	+ 7	3	..
‡Worcester	„ 21	567	+ 7	42	12,166	+ 264	5·75	..
Wrexham	„ 21	194	+ 5	42	4,137	— 48	..	..
Yorks. Wool. Dist.	„ 21	2,056	+ 2	42	41,876	+ 3,117	17	..
Miscellaneous	„ 21	393	— 34	42	9,191	+ 288	..	..
Burnley	„ 29	2,499	+ 72	..	..	..	11·6	1
Burton-on-Trent	„ 30	516	+ 6	30	8,456	+ 134	6·6	..
Bury	„ 30	2,309	+ 96	30½	36,635	— 204	22·5	..
Cardiff	„ 22	4,446	+ 48	30	68,082	+ 742	..	..
Carlisle	..	..	..	..	..	..	..	..
†Chatham and Dist.	„ 20	878	+ 26	42	36,362	+ 1,339	15	..
Cork	„ 27	963	+ 18	43	21,215	+ 1,664	9·89	..
Croydon	„ 21	3,380	— 23	..	50,504	+ 3,438	11·25	..
Darlington	„ 29	411	+ 28	31	6,246	+ 467	..	..
Darwen	„ 28	497	+ 34	30	7,591	— 93	4·36	..
Dover	„ 22	417	+ 15	29	7,030	+ 232	4·75	..
Dublin	„ 28	10,471	+ 190	..	100,807	+ 1,688	54·5	..
Dundee	„ 26	2,351	— 37	23½	28,968	+ 469	15	..
East Ham	„ 29	2,099	+ 162	30½	32,039	+ 1,227	8.52	..
Exeter	„ 28	635	+ 50	30	10,216	— 644	5·5	..
Glasgow	„ 29	36,404	+1,640	..	389,475	+21,534	97·75	3·25
Hastings	„ 27	1,693	— 25	..	..	..	..	..
Huddersfield	„ 29	3,599	+ 347	31	54,095	+ 2,767	28·5	..
Hull	„ 29	5,499	+ 272	30	83,450	+ 4,208	14·5	..
Ilkeston	„ 26	297	— 17	30	3,990	— 216	..	..
Ipswich	„ 29	753	+ 42	30	13,767	+ 743	10·5	..
Kilmarnock	„ 29	288	+ 16	24	3,761	+ 128	4·25	..
Lancashire United	„ 26	2,508	+ 35	..	56,723	— 420	39	..
Leeds	„ 29	13,757	+ 257	30	216,845	+ 6,796	..	..
Leicester	..	..	..	..	..	..	..	..
Leith	„ 29	1,122	+ 7	23½	15,315	+ 116	8·7	..
Liverpool	„ 8	22,729	+ 642	40½	446,905	+15,661	118·5	4
†L.C.C.	„ 19	85,494	+6,642	..	1,218,628	+148,881	132·5	6
London United	„ 29	11,725	+ 580	..	276,836	+12,160	..	..
Lowestoft	..	..	..	..	..	..	..	..
Manchester	„ 29	31,051	+1,760	30	471,382	+ 9,883	183	1
Newcastle	„ 29	8,024	..	..	120,658	+ 954	14·5	..
Newport	„ 22	1,330	+ 13	30	20,820	+ 793	14·5	..
Oldham	„ 30	3,633	+ 207	31	58,231	— 696	23·7	..
Pontypridd	..	..	..	..	..	..	..	..
Portsmouth	„ 22	3,767	— 30	29	65,278	— 1,411	15½	..
Preston	„ 26	1,388	— 75	30	22,242	— 491	..	..
Rotherham	..	..	..	..	..	..	..	..
Salford	„ 31	9,232	+ 524	30	144,516	+ 2,841	..	..
Sheffield	Nov. 1	12,190	+ 778	31½	187,865	+10,877	40	·25
Southampton	Oct. 25	2,107	— 23	30	34,013	+ 730	..	..
Southend-on-Sea	„ 27	939	+ 118	30	20,156	+ 2,324	..	..
South Shields	„ 29	1,134	+ 56	30½	17,593	+ 76	..	..
Swindon	„ 26	295	+ 11	17	4,399	+ 181	..	..
Tyneside	„ 26	886	— 78	17	7,970	+ 242	..	..
Wallasey	„ 29	1,777	+ 108	30	29,790	+ 444	..	..
Walthamstow	„ 29	1,946	+ 135	30	22,542	+ 1,577	9	..
West Ham	„ 28	5,033	+ 223	29	72,854	+ 3,462	16·13	·19
Wolverhampton	„ 26	1,818	— 89	30	28,606	+ 3,220	14·25	1·75
Cen. London Rly.	„ 29	11,424	+ 202	17	91,298	+ 4,247	6·62	..
City & S. Lon. Rly.	„ 30	6,434	— 130	17	52,691	+ 29	7·25	..
Dublin-Lucan Rly.	„ 28	152	+ 12	17	2,241	+ 142	7	..
G.N. and City Rly.	„ 29	2,918	+ 40	17	22,348	+ 709	3·5	..
L'pool Overh'd Rly.	„ 30	2,737	+ 4	..	36,014	+ 445	6·8	4·3
Llandudno-Col. Bay	„ 28	305	+ 12	48½	14,157	+ 413	..	..
London Elec. Ry. Co.	„ 29	26,205	— 205	17	202,495	+ 940	21·25	..
Mersey Railway	„ 29	3,921	+ 18	17	33,425	+ 459	4·5	..
Metropolitan Rly.	„ 30	34,215	+1,045	..	284,078	+ 8,940	24·5	..
Met. District Rly.	„ 29	23,210	+1,343	17	176,905	+10,754	24	..
Anglo-Argentine	„ 28	93,429	+10,299	..	1,912,765	+225,475	..	..
§Auckland	Sept.	14,595	+1,208	13½	45,268	+ 5,044	23·8	1
Bombay (B.E.T.)	Sept. 16	5,500	+ 439	37	99,754	+ 6,935	..	..
§Brisbane	Aug.	21,950	— 47	52	144,795	+13,548	..	..
§Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Oct. 29	6,118	— 358	..	..	..	..	..
§Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	Sept.	4,212	..	..	32,223	..	20·5	..
Madras	Sept. 30	1,286	+ 22	..	24,322	+ 1,406	..	..
Montevideo	Sept.	21,360	+2,332	..	256,979	+25,096	..	..
§Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.)	Oct. 28	2,731	— 54	..	53,639	— 6,314	29	1

* Compared with the corresponding period of 1909. † One week only.
‡ Includes horse, steam and other receipts § One month.

STOCKS AND SHARES.

Tuesday Evening.

The comparative tightness of the Money Market remains a decided influence in the Stock Exchange, and, with various holidays this week in London and other financial centres, business has turned again to the quiet side. The Tramway group is fairly active.

The interesting experiment in Holborn, which seeks to determine more exactly the relative cost and efficiency of electricity and gas for the purpose of street illumination, appears to have been overlooked in the market; some of the dealers admitted that they had not heard of it. Prices remain much about the same as ever. There is a 5s. rise in Charing Cross Ordinary shares, and a fall of 2s. 6d. in St. James's and Pall Mall Ordinary.

Rises in Electric Construction shares are worthy of notice, as they may possibly prove the precursors of further advances. The Ordinary, at 10s., are 2s. 6d. better, and the Preference, at 1½, show an improvement of 5s. These movements would appear to be justified, unless the reason given for them is hopelessly wrong. The Ordinary shares have had no dividend for six years and more, but the 7 per cent. Preference duly received theirs, and were last *ex* the full year's dividend in July.

Home Railway stocks are not much affected by the fresh talk of labour trouble that has arisen in the East and in the West. Prices are dull more than anything else. A slight mishap on the electrified portion of the London and Brighton Railway did not hurt the price of the Deferred stock, which is now a favourite medium for speculation on account of the quotation carrying 10 months' dividend, payable in January. There are rumours current that the Great Eastern is about to start electrifying part of its suburban line. Central London Preferred is a point harder, but Metropolitan Consolidated and Metropolitan District stocks have both eased off to a small extent. There is some talk—at present little more than a rumour—as to the District Railway issuing Second Preference stock. It is said that this security is now held by the Underground Railways of London, and that, in the event of an issue, the latter company would offer it to the public for sale. It might seem rather necessary to put up the prices of the existing stocks if there is any foundation in the rumour.

Latin-Canadian descriptions turned weak, but hardened up again, the fall bringing buyers in. Mexico Tramways have been down to 124, whereas now they are 125½. Rios steadied to 106, after being lower, and a deal of business is doing in the 5 per cent. Gold bonds, which stand at 100¼, the Seconds being 92¼. Para Electric Railways and Lighting Ordinary shares are better at 7⅛ middle, and the company's 5 per cent. First Debenture stock stands at a shade below par. Mexican Light and Power 5 per cent. First Mortgage bonds are again a little lower, in consequence of the competitive attractions of the Pachuca Light and Power bonds, the price of which is about 1 premium on the issue price of 88½. Underwriters to the Pachuca, by the way, received no consideration for their subscriptions beyond the promise of a firm allotment of a fixed amount of the issue.

British Columbia Electric Preferred stock has risen 1, but the Deferred continues dull. Cape Tramways are being picked up at about 7s. 6d., on the idea that the State visit of the Duke and Duchess of Connaught to South Africa may give a fillip to business all round. London Uniteds are quiet.

Latest rumours speak of a much more imposing scheme than that first promulgated by way of agreement between the Anglo-American Telegraph Company and the American Telephone and Telegraph Company. Two or three other concerns are named as likely to make parties to the arrangement, and on the strength of this there are pronounced rallies in the stocks and shares of the two companies most concerned. Direct United States Cable shares have receded a fraction. Eastern Extensions are unaffected by an excellent report. Various *ex* dividend markings are reflected in deductions made from different prices, but Monte Video Telephone Ordinary shares have risen 7½d., in addition to being *ex* a dividend of about the same amount. Other telephone issues are practically unchanged.

Callenders, *ex* 6s., are ¼ lower. Other manufacturing shares are well-nigh motionless, with the exception of Electric Constructions, of which mention has already been made. The Rubber Market relapsed into a condition bordering upon stagnation, business dwindling to a minimum.

British Columbia Electric Railway Co.—It is announced that the issue of 600,000 new shares has been over-applied for.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations Oct. 25th.	Closing Quotations Nov. 1st.	Business done week ended Nov. 1st, 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
		*										£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	4¼ — 4¾	4¼ — 4¾	..	..	..	Nil.
286,500	Do. 5 % Deb. Red. Iss. at 98 % script all paid	Stock	5 %	5 %	5 %	5 %	95 — 97	95½ — 97½	96⅜	96	+ ½	5 2 7
255,196,000	American Telephone & Telegraph, Cap Stock ..	$100	8 %	8 %	8 %	8 %	142 —145	144 —147	..	..	+2	5 8 10
53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	94 — 96	94 — 96	..	..	..	4 3 4
558,460	Anglo-American Telegraph	Stock	3⅞%	3½%	£3 4s.	3⅜%	66 — 68	66 — 68	..	..	..	5 6 7
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	106 —108	106¼—108½	107½	106¼	+ ½	5 10 7
3,220,770	Do. do. do. Deferred	Stock	1¾%	1 %	8/-	25/-	26 — 26½	26⅝ — 27¼	27 1/16	26⅝	+ ⅛	4 11 9
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	9¾ — 10¼	9¾ — 10¼	..	..	..	3 18 1
2,449,176	Commercial Cable, Sting. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	86⅝	85¼	..	4 12 0
16,000	Cuba Telegraph	10	5 %	6 %	6 %	6 %	8¾ — 9¼ xd	8¼ — 9¼ xd	8⅝	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16⅞ — 17⅝	16⅞ — 17⅛ xd	..	..	..	5 15 11
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3⅝ — 3¾	3⅝ — 3¾	..	..	..	5 1 7
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8½ — 9	8¼ — 9	..	..	..	5 11 1
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 5
60,710	Direct United States Cable	20	4½%	4½%	4½%	4 %	15¼ — 16	15⅜ — 15⅞	..	..	— ⅛	5 1 3
36,000	Direct W. India Cable, 4½% Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	130 —133	130 —133	132	130½	..	5 5 3
2,000,000	Do. 8½ % Pref. Stock.	100	8½%	8½%	8½%	8½%	83 — 85	83 — 85	84	83½	..	4 2 4
1,896,708	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	102¾—104¼	101 —103 xd	103½	..	..	3 17 8
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	12¼ — 12⅝	12⅛ — 12⅝	12⅝	12 5/16	..	5 10 11
752,400	Do. 4 % Deb. Stock.	Stock	4 %	4 %	4 %	4 %	100 —102	100 —102	101⅛	..	..	3 18 5
200,000‡	East. & S. Afric. Tel., 4 % Mt. Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅝%	5⅞%	10¼ — 10⅜	10¼ — 10⅜	10⅝	10⅜	..	5 9 5
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13⅛ — 13⅜	13⅛ — 13⅜	13⅜	..	..	4 7 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	20 %	20 %	18 %	18 %	30¾ — 31⅜	30⅛ — 31⅜	..	..	..	5 13 4
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	53 — 55	52½ — 54½	..	..	— ½	5 19 4
$41,380,400	Mackay Companies Common	$100	3½%	4 %	4 %	4½%	94 — 97	94 — 97	..	..	..	4 7 8
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	75 — 80	75 — 80	..	..	..	5 0 0
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	3/16 — 7/16	3/16 — 7/16	16/3	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	6 %	3/4 — 1 xd	3/4 — 1 xd	19/-	18/-	..	6 0 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	1 1/16 — 1 3/16	1 1/16 — 1 3/16 xd	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	104¼—105½	104¼—105½	105¼	104½	..	5 13 9
3,725,000	Do. do. Def. Stock	100	5 %	6 %	6 %	6 %	121 —123	121 —123	122⅛	121⅛	..	4 17 7
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	..	..	..	5 11 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	5 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	..	..	..	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 5/16 — 5 7/16	5 5/16 — 5 7/16	..	..	..	4 9 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	..	..	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red... ..	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 3
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid..	1	7 %	8 %	8 %	8 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	31/6	..	..	4 14 10
50,000	Do. do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	6 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	4 7 3
195,955	Do. do. do. 4 % Red. Deb. Stock..	100	4 %	4 %	4 %	4 %	87¼ — 89½	88 — 90	..	..	+ ½	4 8 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 9 5
11,899	Reuter's	8	5 %	5 %	5 %	5 %	7½ — 8	7½ — 8	..	..	..	5 0 0
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
3,042	Submarine Cables Trust..	Cert.	6 %	6 %	6 %	6 %	130 —133	130—133	..	..	..	4 10 3
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	7⅜ — 7⅝	7⅜ — 7⅝	7 5/16	7 3/16	..	5 8 6
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	5⅝	5 1/16	..	4 7 11
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	2½%	1½ — 1⅝	1⅜ — 1⅝	..	..	..	4 12 8
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930 ..	10	7 %	7 %	7 %	7 %	13⅜ — 14½	13⅞ — 14½	14	..	..	4 18 3
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100—102	100—102	100½	..	..	3 18 5
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	1 3/16 — 1 7/16	1 3/16 — 1 7/16	21/10½	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	8 %	6 %	6 %	6 %	9⅛ — 10½	9⅛ — 10½	9 1/16	..	..	5 17 1
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	£2 6	15 %	14½%	9½ — 10	9½ — 10	..	..	..	6 0 0
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101⅜—103⅜	101⅜—103⅜	..	..	..	4 16 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5% Cum. 1st Pref. 1 to 640,000	5	..	..	..	5 %	4¾ — 5	4¾ — 5	98/9	95/-	..	5 0 0
500,000	Do. 5 % 2nd Pref., 800,000 to 1,300,000	5	..	..	..	5 %	4⅛ — 4¾	4⅛ — 4¾	..	..	..	5 5 3
4,465,674	Do. 4 % Deb. Stock	Stock	..	..	4 %	4 %	92 — 93½	92 — 93½	92⅜	92	..	4 5 7
932,387	Auckland E. Trams, 5 % 1st Mort Deb. Stock ..	100	5 %	5 %	5 %	5 %	103 —105	103 —105	..	..	..	4 15 3
890,000	Babcock & Wilcox, 1 to 890,000	1	20 %	20 %	20 %	24 %	5⅜ — 5⅝	5⅜ — 5⅝	5⅛	5⅜	..	4 4 9
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜ — 1½	1⅜ — 1½	..	..	..	4 0 0
1,000,000	British Aluminium 5 % Mort. Debs. Red.	100	..	..	..	..	..	..	..	..	..	5 9 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	8 %	8 %	8 %	136 —140	136 —140	139½	..	..	5 14 4
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	116 —120	116 —120	118½	..	..	5 0 0
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	108 —111	109 —112	110½	109½	+1	4 9 3
288,000	Do. 4½ % 1st Mort. Deb., 1 to 6,250	40	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
133,301	British Electric Traction	10	Nil	Nil	Nil	Nil	⅞ — 1	⅞ — 1	13/9	..	..	Nil
161,497	Do. do. 6 % Cum. Pref.	10	6 %	8 %	13%	Nil	3⅛ — 3⅜	3⅛ — 3⅜	65/-	..	..	Nil
1,473,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	88 — 92	88 — 92	89⅜	89	..	5 8 8
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	70 — 75	69 — 74 xd	..	..	..	6 0 0
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	10 %	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	6 17 11
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6 — 6⅛	6 — 6⅛	6⅛	..	..	4 12 4
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
201,579	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	Nil	5/16 — 9/16	5/16 — 9/16	..	..	..	Nil
1,316,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	61 — 63	61 — 63	..	..	..	6 7 0
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	11/16 — 13/16	11/16 — 13/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref... ..	2	Nil	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	37 — 42	37 — 42	..	..	..	10 14 4
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	23 — 27	23 — 27	..	..	..	18 19 3
137,610	Calcutta Trams, 1 to 137,610	5	8 %	6 %	4½%	4½%	4½ — 5	4½ — 5	..	..	..	4 10 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,330..	5	5 %	5 %	5 %	5 %	4⅝ — 5⅛	4⅝ — 5⅛	5⅛	..	..	4 17 7
350,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	98 —101	98 —101	99⅛	98	..	4 9 1
35,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	10 %	9½ — 9⅝	9 — 9⅛ xd	9⅛	..	..	5 2 7
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	4 15/16 — 5 1/16	4 15/16 — 5 1/16	..	..	..	4 5 9
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	103¾—105¼	103⅜—105¼	106	..	..	4 5 4
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	12 %	12½%	12½%	3 3/16 — 3 5/16	3 3/16 — 3 5/16	63/-	60/-	..	3 19 4
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	4½%	105 —108	105 —108	..	..	..	4 3 4
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	3 %	3½%	3 %	62 — 64	62 — 64	63	62½	..	4 13 9
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	85 — 87	87	86½	+1	4 12 0
554,655	Do. do. Def. do.	Stock	4 %	2 %	2½%	2 %	44 — 46	44 — 46	..	..	..	4 7 0
1,480,000	City and South London Railway	Stock	2½%	2½%	1½%	1⅜%	27⅛ — 28½	27⅛ — 28½	..	..	..	6 2 10
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	5 %	Nil	Nil	¼ — ½	¼ — ½	..	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	83 — 86	83 — 86	..	..	..	5 17 8

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations Oct. 25th.	Closing Quotations Nov. 1st.	Business done week ended Nov. 1st, 1910. Highest	Lowest	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	6 %	5 %	7/8 — 1	7/8 — 1	..	..	..	5 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	39/32 — 1 1/32	39/32 — 1 1/32	..	..	..	5 11 8
271,080	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12½ — 13½	12½ — 13½	..	..	..	4 8 11
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½%	2½%	Nil	Nil	0 — 1/8	0 — 1/8	..	..	..	Nil
17,139	Do. "A" shares, 01—017,139	5	4½%	2½%	Nil	Nil	1 — 1½	1 — 1½	..	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	63 — 68	63 — 68	..	..	..	5 17 8
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	77 — 80	77 — 80	..	..	..	6 5 0
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	1/4 — 1/2	3/8 — 5/8	..	..	+ 1/8	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	7 %	1 3/8 — 1 5/8	1 3/8 — 1 5/8	..	..	..	10 1 3
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	7 3/4 — 8	7 3/4 — 8	..	..	..	6 5 0
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	80 — 84	80 — 84	..	..	..	4 15 3
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	3/4%	Nil	Nil	3/4 — 1	3/4 — 1	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10 1/4 — 10 3/4	10 1/4 — 10 3/4	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103 1/4	102 —103 1/4	..	..	..	4 16 10
40,000	Henley's (W.T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	12 1/4 — 12 3/4	12 1/4 — 12 3/4	12 3/8	..	..	5 17 8
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 5/16 — 5 7/16	5 5/16 — 5 7/16	..	..	..	5 4 8
150,000	Do. do. 4½ % Mort. Deb Stock	Stock	4½%	4½%	4½%	4½%	107½—109½	107½—109½	109	..	..	4 2 2
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10 %	10 %	10 %	10 %	14½ — 15½	14½ — 15½	..	..	..	6 12 3
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	1/8	Nil	Nil	1 1/8 — 1 1/4	1 — 1½	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	6 — 6½	6 3/8 — 6 7/8	..	..	..	7 5 5
600,070	London United Trams. (1901) 1 to 50,007	10	3 %	3 %	Nil	..	1½ — 2½	1½ — 2½	..	..	..	Nil
399,930	Do. do. 60,008 to 100,000	10	3 %	3 %	Nil	..	1½ — 2½	1½ — 2½	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	3 3/8%	..	1½ — 2½	1½ — 2½	..	..	..	15 0 0
1,649,930	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	67 — 71	67 — 71	..	..	..	5 12 8
5,782,062	Metropolitan Consolidated	100	1 %	1/8%	1/8%	1 %	38½ — 39	38½ — 38¾	39	38½	— 1/4	2 11 7
2,640,914	Do. Surplus Lands	100	23/8%	2 3/8%	2 3/8%	23/8%	66 — 68	66 —68	67 1/8	67	..	4 0 11
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	23 — 23½	22½ — 23¼	23¼	22 13/16	..	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	4½%	5%	3/4 — 7/8	3/4 — 7/8	..	..	..	5 14 3
314,016	Do. do. Defd.	1	Nil	Nil	Nil	..	1/4 — 3/8	1/4 — 3/8	15/-	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	29/32 — 31/32	29/32 — 31/32	16/10½	16/8	..	5 9 7
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	98¾	97⅜	..	4 10 11
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	6 %	126 —128	124½—126½	125	..	—1½	4 14 10
$9,000,000	Do. 1st Mort. 50-year 5 % Gld. Bds.	..	..	..	5 %	5 %	98 — 99	97⅝ — 98⅜	98¼	98	— ½	5 1 3
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	3/8 — 1/2	3/8 — 1/2	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	7/16 — 11/16	7/16 — 11/16	..	..	..	7 5 5
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	82 — 85	82 — 85	..	..	..	5 3 6
37,350	Telegraph Construction and Maintenance	12	15 %	17½%	15 %	17½%	35½ — 37½	35½ — 37½	36	..	..	5 12 0
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 — 103	101 —103	..	..	..	3 17 8
1,000,000	Underground Electric Railway, 5 % Prior Lien	..	..	..	5 %	..	102½—103½	102½—103½	103¼	103	..	4 16 7
2,800,000	Do. do. 4½ % Bonds.	..	..	..	4½%	4½%	92 — 94	92 — 94	93 1/16	93⅛	..	4 14 9
4,900,000	Do. do. 6 % Income Bonds	..	..	..	..	..	37 — 39	37 — 39	..	..	..	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	1	Nil	10 %	5 %	Nil	1/4 — 3/8	1/4 — 3/8	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	5	..	6 %	6 %	3 %	1 — 1½	1 — 1½	..	..	..	10 0 0
245,495	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	60 — 70	60 — 70	..	..	..	5 14 4

ELECTRICITY SUPPLY COMPANIES.

80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10%	10 %	10 %	10 %	6 7/8 — 7 1/8	6 7/8 — 7 1/8	7 1/8	..	..	6 15 7
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6 7/8 — 7 1/8	6 7/8 — 7 1/8	..	..	..	4 14 11
400,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..	3 17 8
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3 1/4 — 3 3/8	3 5/16 — 3 7/16	68/9	..	+ 1/8	6 9 0
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4 1/8 — 4 3/8	4 1/8 — 4 3/8	..	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3 7/8 — 4 1/8	3 7/8 — 4 1/8	..	..	..	4 17 0
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..	4 2 6
49,496	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	4½%	3¾ — 4	3¾ — 4	..	..	..	5 12 6
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	7 %	11¼ — 11⅝	11¼ — 11⅝	11 7/16	11⅛	..	6 5 10
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¼ — 12¼	11½ — 12¼	12	11¼	..	4 19 0
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	120 —124	120 —124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	99½—102½	99½—102¼	101¼	..	..	4 7 10
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	Nil	Nil	1¾ — 2	1¾ — 2	..	..	..	Nil
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2¾ — 3¼	2¾ — 3¼	..	..	..	7 16 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	94¼ — 96½	94¼ — 96½	..	..	..	5 3 8
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅜ — 7⅝	7⅜ — 7⅝	..	..	..	6 7 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10½ — 11¼	10½ — 11¼	..	..	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	4½%	104½—107½	104½—107½	..	..	..	4 3 9
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	99 —101 xd	100½	..	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares	5	Nil	Nil	Nil	Nil	3/8 — 1/2	3/8 — 1/2	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	3 %	Nil	Nil	Nil	1½ — 2	1½ — 2	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	75 — 78	75 — 78	..	..	..	5 15 5
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	5 %	5 %	82½ — 85½	82 — 85	83	..	— ½	5 17 8
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4½ — 4⅝	4½ — 4⅝	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	4 11 11
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
15,000	Hove, 1 to 15,000	5	9 %	8½%	8½%	8½%	6⅜ — 7¼	6⅜ — 7¼	..	..	..	5 19 4
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	101½—103½	101½—103½	..	..	..	4 16 7
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	8 %	8 %	6⅜ — 7⅛	6⅜ — 7⅛	..	..	..	5 10 4
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 3
11,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	2½%	3 %	..	1½ — 1⅞	1½ — 1⅞	..	..	..	4 16 0
70,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	..	4⅛ — 5⅛	4⅛ — 5⅛	99/4½	..	..	5 17 1
382,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½ %	4½%	4 %	4 %	90 — 92	90 — 93	..	..	+ ½	4 6 0
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8 %	6½%	5 %	5 %	3⅛ — 3⅜	3⅛ — 3⅜	69/4½	67/6	..	7 8 2
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	4 17 4
235,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	4½%	102 —105	102 —105	104	..	..	4 5 9
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	82 — 85	82 — 85	..	..	..	4 2 4
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	5 %	89½ — 90½	89½ — 90½	90	89½	..	5 10 6
13,585,000	Do. Light and Power Co., Ltd., Common	$100	..	4 %	3½%	4 %	88 — 89	88 — 89	88¼	87⅞	..	4 9 11
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	7 %	105 —106	105 —106	106	105⅝	..	6 12 1
12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	5 %	5 %	93 — 94	92½ — 93½	93⅜	92¾	+ ½	5 6 11
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96 — 98	96 — 98	..	..	..	4 11 10
180,491	Newcastle-on-Tyne, 1 to 187,500	5	8 %	8 %	2½%	..	3⅜ — 4⅛	3⅜ — 4⅛	..	..	..	2 12 9
187,500	Do. 5 % Pref., 1 to 187,500	5	5 %	5 %	5 %	5 %	4⅜ — 4⅝	4⅜ — 4⅝	..	..	..	5 2 7
150,000	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,500	100	..	..	..	5 %	97½ — 99½	97½ — 99½	..	..	..	5 0 6
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7 %	..	12 — 13	12 — 13	..	..	..	5 7 8
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	7 %	6½ — 6⅝	6½ — 6⅝	..	..	..	5 3 8
119,694	River Plate Elcty. Co. Ord.	Stock	2½%	6 %	8 %	9 %	220—230	220 —230	..	..	..	3 18 3
100,000	Do. do. 6% Non Cum. Pref.	Stock	6 %	6 %	6 %	6 %	100—110	100 —110	..	..	..	5 9 1
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	100½—102½	100½—102½	..	..	..	4 17 7
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	— ⅛	6 2 2
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	4 14 1
150,000	Do. do. 3¾ % Deb. Stock Red.	100	3¾%	3¾%	3¾%	3¾%	84 — 86	84 — 86	..	..	..	4 1 5
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	1½ — 2	1½ — 2	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	3 %	4 %	5 %	5 %	2⅝ — 3	2⅝ — 3	..	..	..	6 13 4
180,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	99 —102	99 —102	..	..	..	4 18 0
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	3/16 — 1/4	3/16 — 1/4	..	..	..	Nil
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 5/32 — 1 3/16	1 5/32 — 1 3/16	..	..	..	6 16 7
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	1/2 — 1	1/2 — 1	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	2 — 2½	2 — 2½	..	..	..	10 0 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	79 — 81	79 — 81	..	..	..	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	..	5 %	..	3/8 — 7/8	3/8 — 7/8	..	..	..	5 14 3
100,000	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	10 %	8 — 8½	8 — 8½	8½	..	..	5 11 1
279	Do. do. 4½ % Cum. Pref. (Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	5 — 5½	5 — 5½	..	..	..	4 1 10

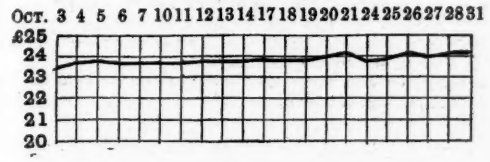
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 5 per cent. October 20th, 1910.

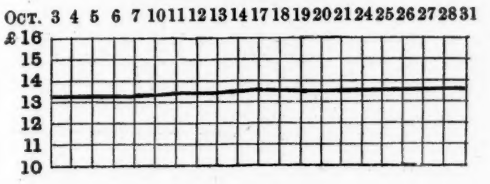
METAL MARKET.

Fluctuations in October.

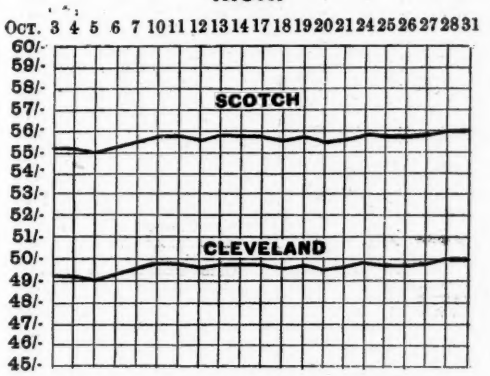
SPELTER (G.O.B's.).



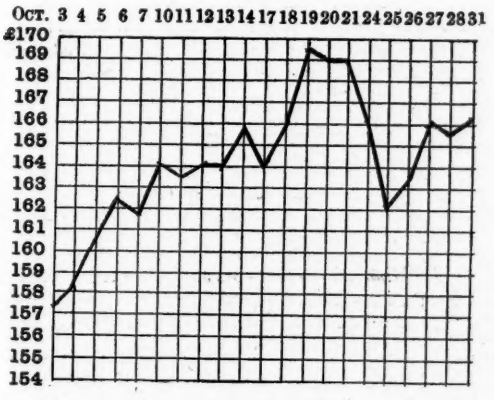
LEAD (ENGLISH).



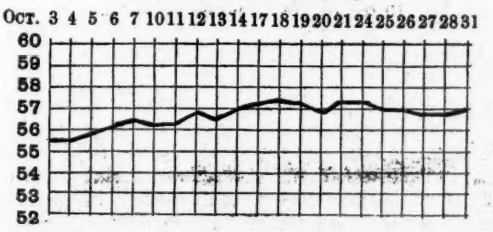
IRON.



TIN.



COPPER (G.M.B's.).



Fife.—The Fife E.P. Co. has decided to add another 2,000-H.P. Curtis turbo-generator to its Townhill plant in order to meet the expected demand of the Wemyss tramways and for other prospective business.

THE BOOK-KEEPING AND ACCOUNTS OF TELEPHONE UNDERTAKINGS.

By GEORGE JOHNSON.

(*Concluded from page* 723.)

Subscriptions in advance is an important feature in the accounts of telephone undertakings, representing as it does the proportion of subscriptions paid or payable in advance—the value of unearned service at the end of the financial year or date of the accounts—only the earned portion of the service being included in the profit and loss account. Its periodical increase is, of course, a proof of increasing revenue, and the amount requires careful calculation.

In the first instance, it may be mentioned, a subscriber's account is debited and a subscriptions account credited with the rents or subscriptions as they fall due for collection according to the Due Dates Register of Contracts, the actual cash collected being credited, of course, to the former account. At the end of the financial year the subscriptions which are bad or irrecoverable are debited to a bad debts account, and credited to subscribers' account. Any allowances may be similarly treated by debiting an allowance account and crediting subscribers' account. The balance of the subscribers' account will then show the total amount of subscriptions overdue and unpaid at the end of the financial year. Provision for doubtful debts therein may be made by debiting profit and loss, and crediting provision for doubtful debts account. The proportion of subscriptions paid and payable in advance may be ascertained in accordance with the subjoined form, and the amount debited to subscriptions account, and credited to a subscriptions in advance account, and written back at the beginning of the succeeding year:—

Subscriptions in advance.

Folio of Due Dates Register.	Name.	Due date.	Amount.		Proportion to end of financial year.	Amount in advance.	Remarks.
			Paid.	Payable.			

At the end of the financial year the local office sends to the London office, along with the usual cash statement and journal entries, the necessary adjusting and closing entries, together with a *pro forma* balance sheet and profit and loss account, stock sheets and other records, properly certified.

The company may pay the Government as its remuneration for the concession a yearly sum, ascertained by a fixed percentage upon the subscriptions or by some other agreed arrangement, varying according to the precise terms and conditions of the concession. For example, it may be on the basis of—

Subscriptions actually collected ... ... £
Less amount paid in advance ... ...

£

Per cent. thereon for royalty.

Or it may be—

Subscriptions paid and payable for the year £
Less amount paid and payable in advance

£

Per cent. thereon for royalty.

Exchange plays an important part in many undertakings located and carried on in foreign countries and States. The subject in relation to many industries, including the valuation of floating assets and liabilities, and other important phases in practice, is fully treated and discussed in the writer's "Exchange in Accounts" and "Contabilidad y Cuentas."

The books in use in the London office for the record of the London transactions are of the usual type. The purchase book may be in the form below:—

Date.	Name.	Particulars.	Personal ledger folio.	Amount.	Total.	Allocation.					
						Local office charges.				London office charges.	
						Stores.	Freights.	Printing and stationery.			

The totals of the columns under "Local Office Charges" are debited to "Local Office" account, and those under "London Office Charges," to the accounts to which they relate.

The cash books are of the usual design, the receipts being entered on the debit side and the payments on the credit, the balance of the principal cash book agreeing with the balance of the pass book, subject to any necessary reconciliation. A statement of the financial position of the undertaking may be prepared for the board monthly on the following lines, viz:—

.....Company.

.....Period.....Date.

Balance as per last Financial Statement	£	£
Details of Receipts since paid into Bank		
Total	£——	£——
Payments made, as per Cheque Agenda Book since last Financial Statement		
Transfers to Deposit or others a/cs		
Bills paid		
Balance as per Cash Book		£——
Deduct payments to Bank, not credited by Bank at date		
Add Cheques not presented at date		
Balance as per Bank Pass Book as per certificate herewith		£——
Balance as per Cash Book, above		£——
Accounts submitted for payment to-day as per Cheque Agenda Book		£——
Financial position (current a/c)		£——
Deposits at Bank as per certificate attached		£——

The foregoing should embrace one side of the statement, whilst on the other should be shown particulars of share Capital, Debentures, Bills Receivable and Payable to receive and to pay, accounts outstanding, and other incidental details.

Periodical statements of the working and progress of the undertaking are, of course, essential, and these, should include the following :—

(1) Statement of Subscribers for the month of ....., 19 .

Exchanges at.	Lines.	Subscribers at commencement of month.		Additional subscribers during the month.		Retirements during the month.		Subscribers at end of month.		Installations in hand at end of month.		Remarks.
		No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	
A	Exchange..											
	Private ..											
	Extension..											
	&c.											
	Total ..											
B	Exchange..											
	Private ..											
	Extension..											
	&c.											
	Total ..											
C	Exchange..											
	Private ..											
	Extension..											
	&c.											
	Total ..											
	Aggregate..											

(2) Statement of Subscriptions for the month of.....19..

Subscriptions due to end of previous month.	Subscriptions due for previous corresponding period.	Subscriptions due during the month.	Subscriptions due for previous corresponding period.	Total due to end of present month.	Total due to end of previous corresponding period.	Total amount received during the month.	Total amount received during previous corresponding period.	No. and amounts outstanding at end of month as per details annexed.	Amount paid into bank H.O. account.

Statement of Exchanges for the month of.....19..

Exchange.	No. of subscribers at beginning of month.	New subscribers.	Retirements.	No. at end of month.	Call Stations. No.	Trunks. No.
A						
B						
C						
Total						

Statement of Faults for the month of ....., 19 .

Exchange.	Lines.	Instruments.	Total.	Proportion per subscriber.	Remarks.
A					
B					
C					
Total					

Statement of Calls for the month of.....19..

Exchange.	Local No.	General No.	Total No.	Proportion per subscriber.	Remarks.
A					
B					
C					
Total					

To the London office there are rendered by the local office, as we have seen, monthly cash statements and journal entries, with the necessary details and vouchers. When received and audited there, the cash statements are entered in a Local Office Cash Book, and the journal entries in a Local Office Journal, both of which are posted to the Local Office Ledger in the London office, that ledger being a summary of the ledger actually in use at the local office. The balances of the Local Office Ledger in the London office are, of course, agreed with the trial balance or *pro forma* balance-sheet and profit and loss account sent by the local office to the London office at the end of the year. The details of procedure will be found in the writer's book on the subject.

A working, or cost statement, may be prepared monthly, as roughly shown below, which, it will be observed, is completed at the London Office.

.....Company.

Working statement for the month of.....19 .

Description.	Amount for the month.	Amount for previous corresponding period.	Description.	Amount for the month.	Amount for previous corresponding period.
Local Charges.			Local Revenue.		
Stores			Subscriptions receivable during the month		
Wages			Proportion for the year ..		
Salaries			(Other forms of revenue to be indicated)		
Shipping charges					
Directors' fees					
Legal charges					
Customs duties					
Light					
Water					
Travelling					
Commission					
Rents payable					
Printing and stationery ..					
Royalties					
Interest					
Bad debts					
(Other charges to be specified)					
Total					
London Charges.			London Revenue.		
Salaries			Bank interest		
Directors' Fees			Transfer fees		
Rents			Discounts		
Interest			(Other forms of revenue to be indicated)		
Printing and stationery ..					
Office expenses					
Debenture interest					
Total					
Aggregate for month					
Amount brought forward ..					
Aggregate to date					
Balance					

It is not possible within the limits of a short paper to treat in detail of the subject of the Accounts of Telephone Undertakings; this has not been attempted.

REVIEWS.

Electric Lighting for Motor-Cars. By Marks & Clerk. London: Technical Publishing Co., Ltd. Price 3s. 6d. net.

Certain problems are met with in connection with the electric lighting of motor-cars which are not encountered in any other application of electricity. These are not easy of solution, as the conditions which obtain are peculiar to automobile work. Messrs. Marks & Clerk, in a book bearing the above title, have endeavoured to state these problems clearly, and to record the solutions so far accomplished or proposed by inventors and manufacturers, as well as to forecast as accurately as possible the probable developments of the future.

Naturally a good deal of space is devoted to the generator and the methods proposed for its regulation, as in car lighting it is necessary that the dynamo should be of fairly constant voltage within wide limits of speed variation. Most of the work which has been done up to the present, in the designing of dynamos of this type, has been in connection with train lighting, where complication and elaboration of apparatus is far more permissible than with machines for lighting motor-cars. The various methods which have been proposed by which to obtain practically constant potential are variation of excitation, variation of reluctance or magnetic resistance, and variation of the position of the armature. Examples of these methods are given at some length. The use of sub-

sidiary brushes connected to the field-magnet windings, as suggested by Tesla as long ago as 1886, as well as the use of auxiliary brushes, as in the Leitner and Lucas system, also receives attention.

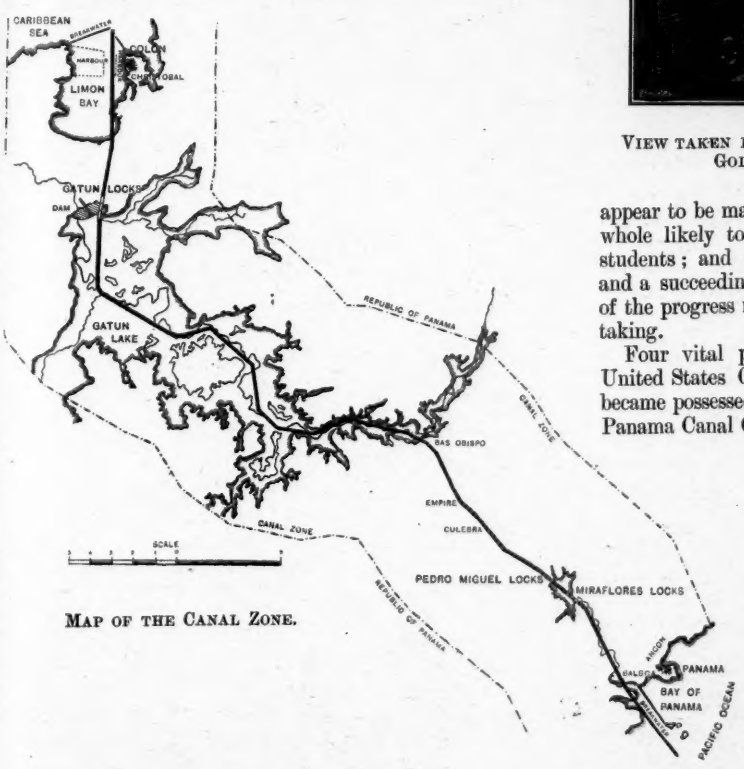
The subject of driving mechanism is dealt with exhaustively, certain forms of friction clutches involving the use of a centrifugal governor adapted to counteract the force of a spring holding the elements of the clutch together, being clearly explained and commented upon. Friction gear controlled by armature action, Stone's system, hydraulic clutches, magnetic clutches and epicyclic gear with hysteresis brake are also treated at considerable length.

The work, it is stated, is primarily intended for designers and manufacturers of electric lighting apparatus for motor-driven vehicles, but there is much in it that will be of interest and value to the electrical engineer.

ELECTRICITY AND THE PANAMA CANAL.—I.

By JOHN GEO. LEIGH.

In the magnificent undertaking in the Isthmus of Panama, initiated by French private enterprise, and now nearing completion under the direct control of the Government of the United States, use has been made of every form of energy known to man, and of every conceivable means for its generation, transmission and application to the purpose to which it has been deemed best adapted. During the earlier stages of American activity following May 4th, 1904—preparation, organisation, sanitation and excavation proper—comparatively little scope was offered for the employment of electricity, except in connection with blasting, as an auxiliary to rock excavation; for increasing the amenities of life, and as a medium of rapid intercourse between administrative departments and distant camps and settlements. Now, however, that the workers on the Canal are engaged largely in rearing the massive structures which will make the completed highway the engineering wonder of modern times, electrical energy has bounded to the fore as the most convenient, economical and powerful of allies.



Map of the Canal Zone.

In the future, moreover, when the Canal has been thrown open to the commerce of the world, and has become one of the most frequented of maritime routes, electricity will reign supreme as the sole force relied upon to discharge the manifold duties connected with its operation. To generate the energy required, there will be erected a hydro-electric station unique among installations of its kind, and a monument of man's triumph over nature, in that its power will be derived from water wasted from Gatun Lake, the artificial inland sea in which will be impounded, for the navigation and service of the Canal, the floods of the unruly Chagres—heretofore, from an engineering point of view, the most serious enemy of the much-discussed and long-awaited inter-oceanic waterway.

Opportunity to discuss in some detail the plans and purposes of this power station will be afforded in a future issue of the Electrical Review. Pending this, however, there appear to be many points affecting the Canal enterprise as a whole likely to be of interest to electrical engineers and students; and these I propose to indicate, in the present and a succeeding article, in connection with a brief survey of the progress made towards the completion of the undertaking.

View taken in the Culebra Cut looking South, showing Goldhill, 600 ft. High, on the Left.

Four vital problems awaited definite solution when the United States Government, at a cost of only $40,000,000, became possessed of all the rights and properties of the New Panama Canal Co., and, in exchange for a further amount of $10,000,000, secured sovereign rights in perpetuity over what is known as the Canal Zone—the territory (other than the cities of Panama and Colon) extending five miles on either side of the centre line of the Canal.

The first problem was the notorious unhealthiness of the region, a matter of great importance not only in relation to the completion of the waterway, but also to its prospects when opened. No Government, it was felt, dared risk a recurrence among its employés of the mortality and sickness which had attended the building of the Panama Railroad and the *régime* of the French Canal companies, nor face the possibility that transit through the completed Canal might properly be regarded as a menace to the public health. Therefore, almost the first step taken was to create a Sanitation Department invested with far-reaching powers, destined, it was hoped, in a brief period to cleanse the Canal Zone and purify the Panamanian cities, long hot-beds of disease, but now, by virtue of the treaty enacted in 1903, subject to United States sanitary jurisdiction. The task proved a longer and more costly one than had been anticipated, but so efficacious have been the measures put in force, that for some years past every part of the Isthmus where American influence is predominant has been able to challenge comparison in respect of health provisions and freedom from

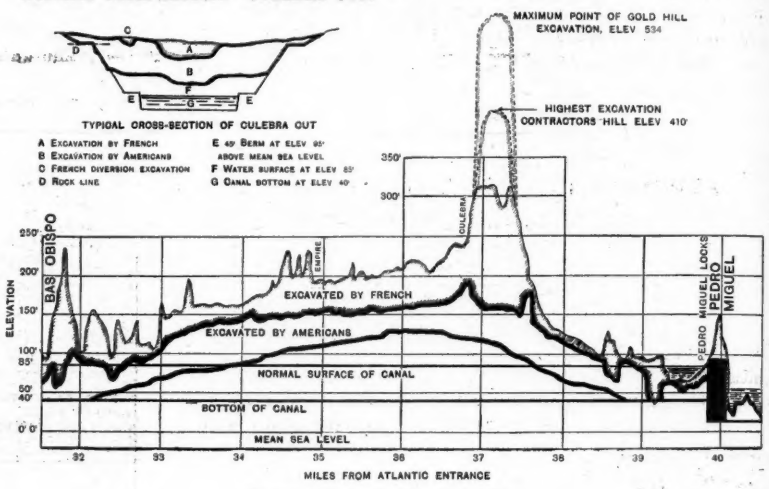
disease with not only tropical countries, but even the best-regulated communities of Europe and the United States.

Each of the other problems comes within the realm of engineering. Stretching from the Arctic ocean through the three Americas to the southern limit of Patagonia is a chain of mountains, known under various names, but never entirely broken. Nowhere in Central America has this range a lower elevation than between the valleys of the Chagres and the Rio Grande, and to this fact, combined with the extent and direction of the Chagres valley, must be attributed the long-established recognition of the line adopted for the Canal as the ideal route for inter-oceanic communication—whether by road, railway, or artificial maritime channel. Aided by modern machinery and explosives, the piercing *per se* of the mountain range raised no special technical question. It involved prolonged and costly labour, but, above all, organisation of a high order, to secure the expeditious despatch of the excavated material from a comparatively restricted area to judiciously-selected dumping grounds or to sites where the spoil might be of value. The maximum natural elevation when the French commenced operations in 1882 was 534 ft. above mean sea-level, other elevations and the depth of excavation accomplished by the two companies being indicated in the accompanying profile of the Culebra division of the Canal. This illustration may serve to remind readers of the really great work performed by the French pioneers of the enterprise; while that which follows is no less interesting as showing the great difference in the width of the channels proposed by them and their successors, and the consequent largely increased excavation on either side of the Canal axis demanded by the American plans. During the period the French had control of the undertaking, the total excavation along the Canal line amounted to about 80,000,000 cubic yards. Much of this, however, was concerned with the cutting of river diversions, raising of levées and work of like character; while not a little of the soil was deposited along the sides of the proposed Canal in such manner as to require re-handling as soon as a wider channel was demanded. To these circumstances must be attributed the fact that of the aggregate excavation by the French, only about 30,000,000 cb. yards can be regarded as useful in connection with the present plans.

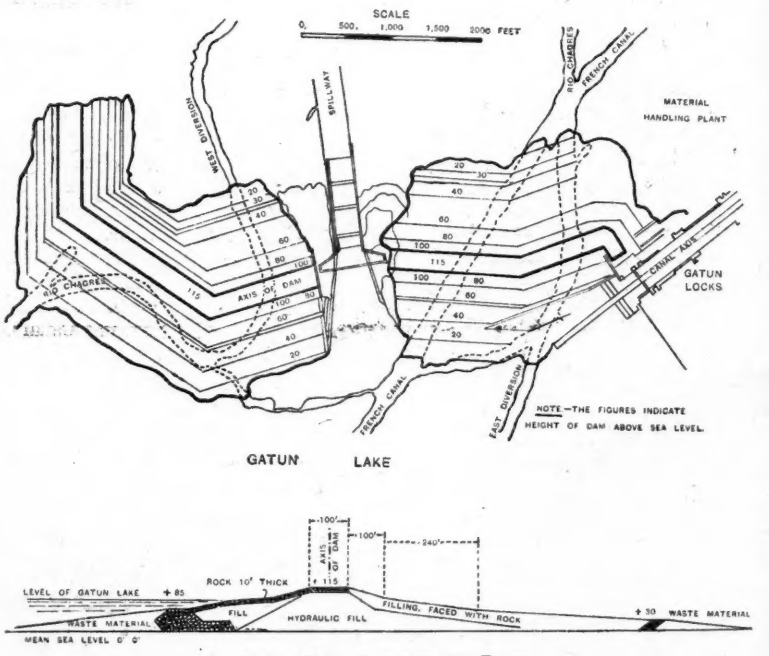
Most important of all the problems associated with the design and construction of the Canal was the necessity of protecting the works and providing for the security of navigation against the violent floods which periodically, during the rainy season, sweep from the upper reaches of the Rio Chagres into the valley traversed by its waters during their passage to the Caribbean Sea. These ends will be achieved by closing the valley in the neighbourhood of Gatun by a great dam, provided with a waste weir and regulating works. This, with the hills east and west of the Canal line, will create a basin, about 175 sq. miles in area, into which all the flood waters of the Chagres and other streams can be received and impounded to form a lake with a surface normally at an elevation of 85 ft. above mean sea level. By the same expedient, also, will be solved the fourth problem to which reference has been made—that of providing adequate supplies of water for lock operation and other requirements of the Canal.

The Atlantic entrance to the latter will be between two breakwaters, one 10,500 ft., and the other 5,700 ft. long, designed to protect shipping approaching the terminal or lying in the harbour south of it from the "northers" and their accompanying high waves, to which Colon and Limon Bay are at present exposed. From this point a channel, 500 ft. wide, dredged through the bay and excavated from the shore line, leads to Gatun, a distance of 6·76 miles. At Gatun a flight of three twin locks, each 1,000 ft. long, 110 ft. wide, and allowing for $41\frac{1}{3}$ ft. of water over the sills, will raise vessels from the sea level to that of Gatun Lake, or lower them from the lake to the sea-level channel. From Gatun to Bas Obispo (23·59 miles) navigation will be through the lake in channels varying in bottom width from 1,000 ft. to 500 ft. At Bas Obispo begins the cutting through the so-called Continental divide, the channel for a distance of 8·11 miles being 300 ft. wide at the bottom, the surface of the water remaining at the lake level. At Pedro Miguel vessels will be lowered 30 ft. to a small lake, created by dams closing up valleys through which flowed small but inconvenient rivers. The channel between Pedro Miguel and the locks at Miraflores will be 500 ft. wide and nearly a mile long. At Miraflores the descent to the Pacific level will be made by twin locks of two flights; and thence to deep water in Panama Bay, a distance of 8·81 miles, the

Typical Cross-Section—Culebra Cut.



Profile of the Culebra Cut.



Gatun Dam, Section and Plan.

channel will be 500 ft. wide and 45 ft. deep at mean tide. Along one side of the Pacific entrance, to protect the latter from possible inroads of silt from the sandy bottom of Panama Bay, there is being built a breakwater with rock excavated in the Culebra cutting.

Owing to its dimensions, design and the important duties it will be called upon to perform, Gatun Dam must be regarded as the most noteworthy structural work along the line of the Canal. It will be 1½ miles long, 115 ft. high, and 2,600 ft. wide at the bottom. Near the centre, facing the lake, will be the works for regulating the amount of water retained in the latter, and below these, in a concrete-lined spillway, will be erected the hydro-electric station destined to supply all the power required for the operation of the Canal. There will be required in the construction of Gatun Dam about 12,000,000 cb. yards of dredged material and 7,000,000 cb. yards of rock fill, of which up to the present there have been placed approximately 5,500,000 cb. yards of each class of material.

That excavation proper no longer occupies a controlling position in determining a date for the completion of the Canal, will be evident from the following table, showing the work accomplished by the Americans up to the end of August, and the amounts of rock which then required to be removed in the various divisions from the channel and the sites of accessory works :—

Division.	Amount excavated. Cubic yards.		Estimated amount of excavation required. Cubic yards.	
Atlantic—				
Dry excavation	7,262,309	26,864,971	1,010,745	16,492,374
By dredges ...	19,602,662		15,481,629	
Central—				
Culebra Cut ...	51,826,590	61,747,577	32,360,134	35,377,441
Other points ...	9,920,987		3,017,307	
Pacific—				
Dry excavation	2,910,920	27,280,648	3,469,222	14,774,755
By dredges ...	24,369,728		11,305,533	
Grand totals		115,893,196		66,644,570

Equally interesting is the following summary, as showing the increased efficiency of the operations during recent years, resulting from improved organisation :—

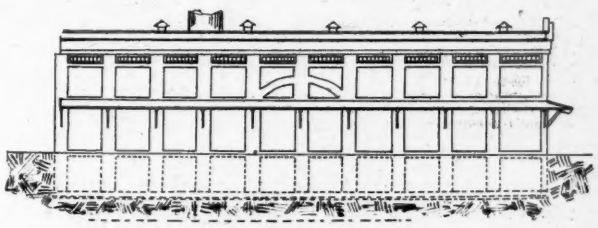
	Cubic yards.
Excavation by the French companies	78,146,960
Useful to the present Canal	29,908,000
Evcavation by the Americans—	
May 4th, 1904, to Dec. 31st, 1904...	243,472
Year 1905	1,799,227
Year 1906	4,948,497
Year 1907	15,765,290
Year 1908	37,116,735
Year 1909	35,096,166
Year 1910, to August 31st... ...	20,923,809
	115,893,196

The improvement is the more noteworthy when we bear in mind that the material excavated during recent years has been almost wholly hard rock, that very little difference is now observable in the output of the rainy and dry seasons, and that to the work of excavation proper is now added that of lock and dam construction. The hardness of the material requiring excavation may be gathered from the fact that the estimated quantity of dynamite to be used for blasting during the current financial year is 13,727,000 lb., in connection with which there will be required 975,950 electric fuses and 1,619,000 ft. of connecting wire. As aid to an appreciation of the point concerning the rainy seasons, it will be sufficient to remark that a monthly rainfall of over 20 in. is not uncommon in the Central division, and that a precipitation of more than 2 in. in 40 minutes was recently recorded.

During the early years of the American occupation of the Zone, electric lighting plants were established at Empire, Gorgone, and other places, for the purpose of lighting all the villages and camps along the Canal line ; and these from time to time have been enlarged as the area of operations has extended, and the working force on the Canal and railway—for some time past never less than 50,000 men—has increased. More recently, in connection with the building of the locks, power plants have been put in operation at Gatun and Miraflores, the first serving not only to supply current required for constructional purposes, but also for lighting Colon, Cristobal, Mount Hope and Gatun, and for operating the manufacturing plants of the Commissary Department at Cristobal.

The power plant at Gatun occupies a building 150 ft. long, 77 ft. wide, and 48 ft. high from the ground floor to the peak of the gables. The building is in two parts, each running parallel with the other and having a gable roof. The substructure is of concrete, and the superstructure a wooden frame, the closed parts of which are covered with corrugated iron.

The boiler equipment consists of six water-tube boilers of the Keeler type, arranged in batteries of two. Each boiler has a nominal rating of 400 H.P., is equipped with Foster superheaters, and is guaranteed to evaporate 17,000 lb. of water per hour from a feed-water temperature of 210° F., at a pressure of 205 lb. absolute, and with 150° F. of superheat. Crude oil is used as fuel, but the furnaces are fitted with shaking grates in order that coal may be substituted in case of need. The induced-draught system includes two 90-in. fans placed near the stack, one directly connected to a vertical compound engine, and the other to a 100-H.P. 220-volt three-phase induction motor. Among the other equipment of the boiler room may be mentioned two vertical and double-acting feed-water pumps, and a Cochrane feed-water heater and purifier. Each of



Front Exterior of the Miraflores Power Station.

The dotted lines indicate the concrete foundation and basement section below the surface of the ground.

the former is capable of delivering 200 gallons of water per minute, at a temperature of 205° F., against a discharge pressure of 225 lb., when supplied with steam at 175-lb. gauge pressure, superheated to 150° F., while the latter is guaranteed to heat 80,000 lb. of water per hour from 100° F. to a temperature of 205° F., when supplied with 80,000 lb. of exhaust steam from non-condensing auxiliaries.

In the engine room are installed three Curtis 1,500-KW. 2,200-volt three-phase 25-cycle turbo-generators, with base condensers ; two 35-KW. 125-volt turbo-exciters ; one 30-KW. 125-volt induction motor-driven exciter ; and two 500-KW. 600-volt and one 300-KW. 600-volt rotary converters. The guaranteed steam consumption of the turbines is 17·6 lb. per KW.-hour when operating at 100 per cent. load, with 150 lb. steam pressure and 12 KW. excitation at 125 volts. With each rotary converter are three air-blast transformers and a reactance coil, each transformer having a primary voltage of 2,200, a secondary voltage of 430 and a capacity of 185 KW. For supplying air for the transformers, two blowers, with direct-coupled motors, each having a capacity of 10,000 cb. ft. per minute, at ¾ oz. pressure to the square in., are installed. In the basement beneath this machinery is an air chamber, into which air is forced by the blowers to escape through flues or openings in the floor. There is one flue under each transformer and reactance coil, for supplying air for ventilating purposes.

Between the bank of transformers, reactance coils and rotary converters and the boiler room wall are placed a controlling switchboard, an exciter switchboard, a feeder switchboard and an air compressor, the last motor-driven and supplying air at 150 lb. pressure to the square inch for the blowing system, for cleaning the electrical equipment and other purposes. All A.C. switches, generator field switches, turbine generator control switches, and generator field rheostat control switches are controlled from a three-section benchboard, on each section of which are mounted the following push button-control switches, with indicating lamps :—Generator switch ; rotary converter

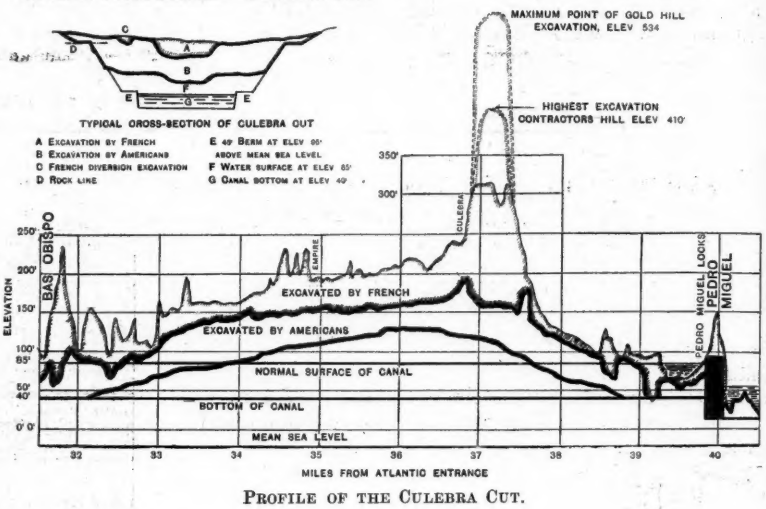
disease with not only tropical countries, but even the best-regulated communities of Europe and the United States.

Each of the other problems comes within the realm of engineering. Stretching from the Arctic ocean through the three Americas to the southern limit of Patagonia is a chain of mountains, known under various names, but never entirely broken. Nowhere in Central America has this range a lower elevation than between the valleys of the Chagres and the Rio Grande, and to this fact, combined with the extent and direction of the Chagres valley, must be attributed the long-established recognition of the line adopted for the Canal as the ideal route for inter-oceanic communication—whether by road, railway, or artificial maritime channel. Aided by modern machinery and explosives, the piercing *per se* of the mountain range raised no special technical question. It involved prolonged and costly labour, but, above all, organisation of a high order, to secure the expeditious despatch of the excavated material from a comparatively restricted area to judiciously-selected dumping grounds or to sites where the spoil might be of value. The maximum natural elevation when the French commenced operations in 1882 was 534 ft. above mean sea-level, other elevations and the depth of excavation accomplished by the two companies being indicated in the accompanying profile of the Culebra division of the Canal. This illustration may serve to remind readers of the really great work performed by the French pioneers of the enterprise; while that which follows is no less interesting as showing the great difference in the width of the channels proposed by them and their successors, and the consequent largely increased excavation on either side of the Canal axis demanded by the American plans. During the period the French had control of the undertaking, the total excavation along the Canal line amounted to about 80,000,000 cubic yards. Much of this, however, was concerned with the cutting of river diversions, raising of levées and work of like character; while not a little of the soil was deposited along the sides of the proposed Canal in such manner as to require re-handling as soon as a wider channel was demanded. To these circumstances must be attributed the fact that of the aggregate excavation by the French, only about 30,000,000 cb. yards can be regarded as useful in connection with the present plans.

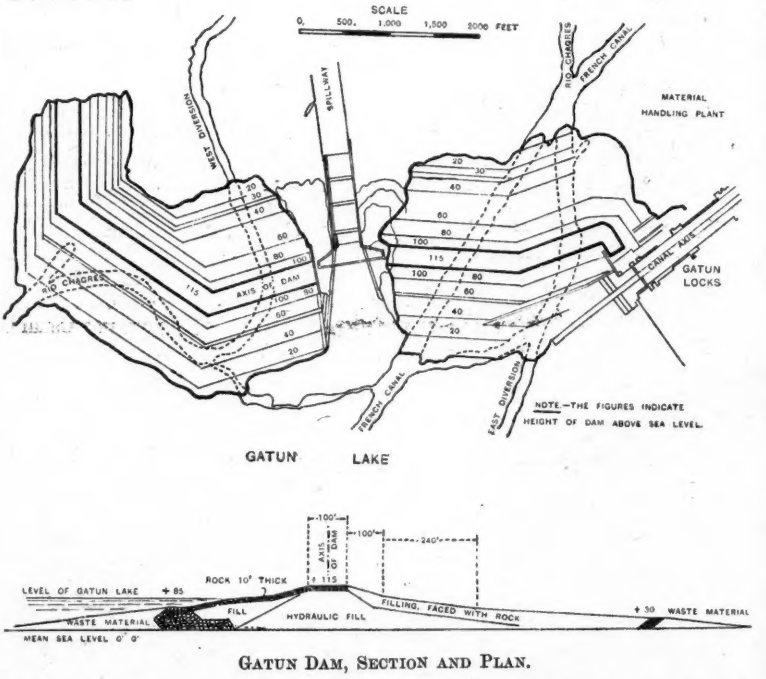
Most important of all the problems associated with the design and construction of the Canal was the necessity of protecting the works and providing for the security of navigation against the violent floods which periodically, during the rainy season, sweep from the upper reaches of the Rio Chagres into the valley traversed by its waters during their passage to the Caribbean Sea. These ends will be achieved by closing the valley in the neighbourhood of Gatun by a great dam, provided with a waste weir and regulating works. This, with the hills east and west of the Canal line, will create a basin, about 175 sq. miles in area, into which all the flood waters of the Chagres and other streams can be received and impounded to form a lake with a surface normally at an elevation of 85 ft. above mean sea level. By the same expedient, also, will be solved the fourth problem to which reference has been made—that of providing adequate supplies of water for lock operation and other requirements of the Canal.

The Atlantic entrance to the latter will be between two breakwaters, one 10,500 ft., and the other 5,700 ft. long, designed to protect shipping approaching the terminal or lying in the harbour south of it from the "northers" and their accompanying high waves, to which Colon and Limon Bay are at present exposed. From this point a channel, 500 ft. wide, dredged through the bay and excavated from the shore line, leads to Gatun, a distance of 6·76 miles. At Gatun a flight of three twin locks, each 1,000 ft. long, 110 ft. wide, and allowing for 41½ ft. of water over the sills, will raise vessels from the sea level to that of Gatun

Typical Cross-Section—Culebra Cut.



Profile of the Culebra Cut.



Gatun Dam, Section and Plan.

Lake, or lower them from the lake to the sea-level channel. From Gatun to Bas Obispo (23·59 miles) navigation will be through the lake in channels varying in bottom width from 1,000 ft. to 500 ft. At Bas Obispo begins the cutting through the so-called Continental divide, the channel for a distance of 8·11 miles being 300 ft. wide at the bottom, the surface of the water remaining at the lake level. At Pedro Miguel vessels will be lowered 30 ft. to a small lake, created by dams closing up valleys through which flowed small but inconvenient rivers. The channel between Pedro Miguel and the locks at Miraflores will be 500 ft. wide and nearly a mile long. At Miraflores the descent to the Pacific level will be made by twin locks of two flights; and thence to deep water in Panama Bay, a distance of 8·81 miles, the

channel will be 500 ft. wide and 45 ft. deep at mean tide. Along one side of the Pacific entrance, to protect the latter from possible inroads of silt from the sandy bottom of Panama Bay, there is being built a breakwater with rock excavated in the Culebra cutting.

Owing to its dimensions, design and the important duties it will be called upon to perform, Gatun Dam must be regarded as the most noteworthy structural work along the line of the Canal. It will be 1½ miles long, 115 ft. high, and 2,600 ft. wide at the bottom. Near the centre, facing the lake, will be the works for regulating the amount of water retained in the latter, and below these, in a concrete-lined spillway, will be erected the hydro-electric station destined to supply all the power required for the operation of the Canal. There will be required in the construction of Gatun Dam about 12,000,000 cb. yards of dredged material and 7,000,000 cb. yards of rock fill, of which up to the present there have been placed approximately 5,500,000 cb. yards of each class of material.

That excavation proper no longer occupies a controlling position in determining a date for the completion of the Canal, will be evident from the following table, showing the work accomplished by the Americans up to the end of August, and the amounts of rock which then required to be removed in the various divisions from the channel and the sites of accessory works :—

Division.	Amount excavated. Cubic yards.		Estimated amount of excavation required. Cubic yards.	
Atlantic—				
Dry excavation	7,262,309	26,864,971	1,010,745	16,492,374
By dredges ...	19,602,662		15,481,629	
Central—				
Culebra Cut ...	51,826,590	61,747,577	32,360,134	35,377,441
Other points ...	9,920,987		3,017,307	
Pacific—				
Dry excavation	2,910,920	27,280,648	3,469,222	14,774,755
By dredges ...	24,369,728		11,305,533	
Grand totals		115,893,196		66,644,570

Equally interesting is the following summary, as showing the increased efficiency of the operations during recent years, resulting from improved organisation :—

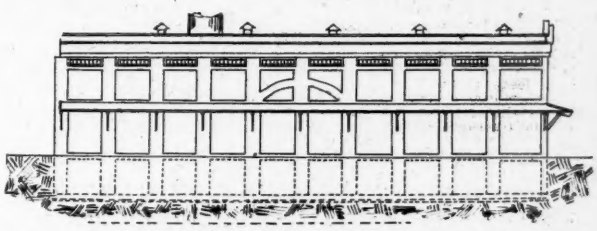
	Cubic yards.
Excavation by the French companies	78,146,960
Useful to the present Canal	29,908,000
Evcavation by the Americans—	
May 4th, 1904, to Dec. 31st, 1904...	243,472
Year 1905	1,799,227
Year 1906	4,948,497
Year 1907	15,765,290
Year 1908	37,116,735
Year 1909	35,096,166
Year 1910, to August 31st... ...	20,923,809
	115,893,196

The improvement is the more noteworthy when we bear in mind that the material excavated during recent years has been almost wholly hard rock, that very little difference is now observable in the output of the rainy and dry seasons, and that to the work of excavation proper is now added that of lock and dam construction. The hardness of the material requiring excavation may be gathered from the fact that the estimated quantity of dynamite to be used for blasting during the current financial year is 13,727,000 lb., in connection with which there will be required 975,950 electric fuses and 1,619,000 ft. of connecting wire. As aid to an appreciation of the point concerning the rainy seasons, it will be sufficient to remark that a monthly rainfall of over 20 in. is not uncommon in the Central division, and that a precipitation of more than 2 in. in 40 minutes was recently recorded.

During the early years of the American occupation of the Zone, electric lighting plants were established at Empire, Gorgone, and other places, for the purpose of lighting all the villages and camps along the Canal line; and these from time to time have been enlarged as the area of operations has extended, and the working force on the Canal and railway—for some time past never less than 50,000 men—has increased. More recently, in connection with the building of the locks, power plants have been put in operation at Gatun and Miraflores, the first serving not only to supply current required for constructional purposes, but also for lighting Colon, Cristobal, Mount Hope and Gatun, and for operating the manufacturing plants of the Commissary Department at Cristobal.

The power plant at Gatun occupies a building 150 ft. long, 77 ft. wide, and 48 ft. high from the ground floor to the peak of the gables. The building is in two parts, each running parallel with the other and having a gable roof. The substructure is of concrete, and the superstructure a wooden frame, the closed parts of which are covered with corrugated iron.

The boiler equipment consists of six water-tube boilers of the Keeler type, arranged in batteries of two. Each boiler has a nominal rating of 400 H.P., is equipped with Foster superheaters, and is guaranteed to evaporate 17,000 lb. of water per hour from a feed-water temperature of 210° F., at a pressure of 205 lb. absolute, and with 150° F. of superheat. Crude oil is used as fuel, but the furnaces are fitted with shaking grates in order that coal may be substituted in case of need. The induced-draught system includes two 90-in. fans placed near the stack, one directly connected to a vertical compound engine, and the other to a 100-H.P. 220-volt three-phase induction motor. Among the other equipment of the boiler room may be mentioned two vertical and double-acting feed-water pumps, and a Cochrane feed-water heater and purifier. Each of



Front Exterior of the Miraflores Power Station.

The dotted lines indicate the concrete foundation and basement section below the surface of the ground.

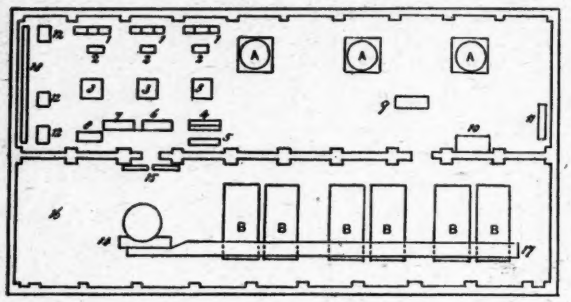
the former is capable of delivering 200 gallons of water per minute, at a temperature of 205° F., against a discharge pressure of 225 lb., when supplied with steam at 175-lb. gauge pressure, superheated to 150° F., while the latter is guaranteed to heat 80,000 lb. of water per hour from 100° F. to a temperature of 205° F., when supplied with 80,000 lb. of exhaust steam from non-condensing auxiliaries.

In the engine room are installed three Curtis 1,500-KW. 2,200-volt three-phase 25-cycle turbo-generators, with base condensers; two 35-KW. 125-volt turbo-exciters; one 30-KW. 125-volt induction motor-driven exciter; and two 500-KW. 600-volt and one 300-KW. 600-volt rotary converters. The guaranteed steam consumption of the turbines is 17·6 lb. per KW.-hour when operating at 100 per cent. load, with 150 lb. steam pressure and 12 KW. excitation at 125 volts. With each rotary converter are three air-blast transformers and a reactance coil, each transformer having a primary voltage of 2,200, a secondary voltage of 430 and a capacity of 185 KW. For supplying air for the transformers, two blowers, with direct-coupled motors, each having a capacity of 10,000 cb. ft. per minute, at ¾ oz. pressure to the square in., are installed. In the basement beneath this machinery is an air chamber, into which air is forced by the blowers to escape through flues or openings in the floor. There is one flue under each transformer and reactance coil, for supplying air for ventilating purposes.

Between the bank of transformers, reactance coils and rotary converters and the boiler room wall are placed a controlling switchboard, an exciter switchboard, a feeder switchboard and an air compressor, the last motor-driven and supplying air at 150 lb. pressure to the square inch for the blowing system, for cleaning the electrical equipment and other purposes. All A.C. switches, generator field switches, turbine generator control switches, and generator field rheostat control switches are controlled from a three-section benchboard, on each section of which are mounted the following push button-control switches, with indicating lamps :—Generator switch; rotary converter

switch; bus-bar switch; four outgoing feeder switches; generator field switch; turbine governor control switch; and generator field rheostat control switch.

On the upper vertical section of the board are mounted the indicating instruments, and on a three-panel vertical board in the rear are the recording instruments and time-limit relays. The exciter board consists of three exciter and two regulator panels, and the railway, or 600-volt, board of three rotary



Ground-Floor Plan of the Gatun and Miraflores Power Houses.

A. Turbo-generators.
B. Boilers.
1. Three sets of transformers, three transformers in each set.
2. Three reactance coils, one to each set of transformers.
3. Three rotary converters.
4. Benchboard.
5. Relay and recording meter.
6. Exciter board.
7. D.C. feeder board.
8. Air-compressor motor, induced-draught fan motor, and station light transformers.
9. Feed pumps.
10. Feed-water heater.
11. Motor-driven air-compressor.
12. Oil switches, one for each turbo-generator and rotary converter.
13. Stack.
14. Induced-draught fans.
15. Oil filter and storage tanks.
16. Machine shop.
17. Breeching connecting boilers to induced-fan system.
18. Feeder oil-switches.

and six feeder panels. Along the south end of the room are the oil switches, solenoid operated, by means of which the turbine generators and rotary converters are connected with the station bus. To this bus are connected switches of the same type controlling the feeder circuits for supplying the entire handling plant.

Both as regards equipment and its arrangement, the central station of the Pacific division is practically a duplicate of that at Gatun, already described. The plant occupies a building 157½ ft. × 76½ ft., which has a 14-ft. basement. The eaves are 39 ft. and the gable 41 ft. from the ground floor, and there is a 3-ft. parapet surmounting the outer walls. The entire building is of reinforced concrete construction, with the exception of one end and that portion of the turbine room floor on which the switchboard and rotary converters are installed. These parts are of lighter construction and easily removable, in view of proposed changes and the probable installation of water turbines after the completion of the Miraflores locks. Surrounding the outer walls of the boiler room, about 17 ft. from the floor, is a concrete canopy extending out 11 ft., below which the panels are left open, giving increased light and ventilation. Below the basement floor are the circulating water intake and discharge tunnels, also of reinforced concrete construction.

The Miraflores plant has a capacity equivalent to 6,000 H.P., the power generated being delivered by overhead three-phase transmission lines to the concrete handling plants at Pedro-Miguel and Miraflores, various electrically-driven pumps, the crushing plant at the Ancon quarry, and the sand unloading cranes at Balboa, where a 300-KW. rotary converter is installed. The lines to the Ancon quarry are approximately 5½ miles in length, and that to Balboa is about 4 miles.

Earth Return.—For more than a year a Commission of the Swiss Electrotechnical Society has had under observation the use of the earth as a return conductor between St. Maurice and Lausanne, and *l'Industrie Electrique*, quoting from a report of the Commission, states that the system has worked satisfactorily from the moment when it was put in regular service, without a single derangement. Direct current at 20,000 volts is used, on the Thury system, with a single line conductor, the second line conductor having been idle during the past 14 months. No complaints have been made by the engineers of the Federal railways, the compensating batteries installed at certain stations having absolutely prevented interference with the railway signals.

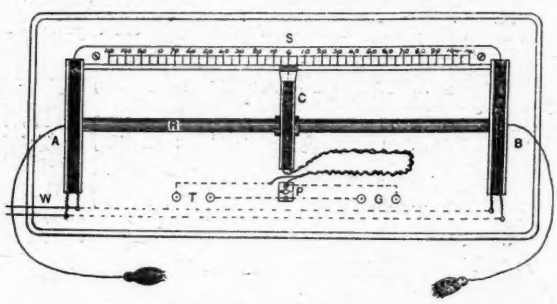
USES OF THE INDUCTION BALANCE AND ITS APPLICATIONS IN TELEPHONY.

By C. A. SMITH, A.Am.I.E.E., Birmingham.

It is a little more than 30 years since the late Prof. Hughes invented his four-coil induction balance for the purpose of examining the electrical properties of metals, and devised his sonometer, or induction bridge, with which he endeavoured to measure the self-induction of wires. It was during these investigations that he discovered that the induction balance gave "exquisite" definitions of one's own hearing powers, and by its means observed that one's hearing varied with the state of health and also the weather.

He thereupon constructed his "audiometer," or three-coil balance, which at the time, like most of his ingenious and simple inventions, drew a deal of attention from scientists and engineers, many of whom are still living, and will have pleasant recollections of the animated meetings held to discuss the admirable achievements of that wonderful man.

With the rapid advances made in electrical research and the improved methods employed now, one rarely hears any mention of Hughes's balance or audiometer. Why the latter instrument is not in common use amongst medical men—



The Audiometer.

particularly ear specialists and in our ear hospitals—one cannot understand. At the time when Dr. Richardson, M.D., LL.D., described it, and gave the results of his experiments with it, before the Royal Society in 1879, no doubt philosophical instrument manufacture was a costly matter, and the art, perhaps, not so well understood as it is to-day.

The electrical audiometer, the subject of this article, is an instrument of simple design, but requires to be made with care and refinement to obtain the excellent results possible.

Briefly, it consists of two flat coils A and B (see sketch), about 7½ cm. in diameter and 1 cm. deep, which are fixed upon a suitable base-board in a vertical position, about 25 cm. apart, with their planes parallel and their similar pole-faces in opposition to each other. These coils are wound with the same length of insulated copper wire, so as to have an equal resistance, from 60 to 100 ohms, and to produce exactly equal opposing field strengths.

Between these two coils, a third smaller one, or "search coil," C, wound with finer wire, and about 5 cm. in diameter and 7 mm. deep, is made to slide to and fro along a vulcanite rod R. This rod is grooved the entire length longitudinally underneath, to allow a pin, fixed into reel C, to slide along, when either of the silk cords shown is pulled.

The search coil is supplied with a vernier, which slides edge to edge with the fixed scale S, and is connected-up to two pairs of terminals T and G, and plug-switch P.

The scale is divided into 110 millimetre divisions on either side of a centre zero.

The two coils A and B are connected together in parallel, and operated by a suitable tone vibrator, or standard telephone set reserved for the purpose. Either would, of course, be placed away from the balance, so as not to be audible without the receiver belonging to the apparatus. Since the two coils A and B are constructed to be equal and opposite electrically, the opposing magnetic fields produced will have no effect upon the search coil when it occupies the central or nodal position, and the telephone will be mute. If, how-

ever, it be moved towards either A or B, it will be "out of balance," and the telephone will sound accordingly.

To test the hearing, it is only necessary to apply the vibrator or standard telephone set, beginning with the search coil well out of balance, and gradually moving it towards the centre until the sound or voice is just audible. This should be repeated on the opposite side of zero, and the mean taken for each person or ear tested.

By this simple and rapid method doctors can accurately determine the state of their patients' hearing, and note the benefits derived from the treatments applied.

Similarly a telephone company can ascertain the qualities of the operators' hearing upon their engagement, and also examine the acoustic values of receivers, with it. From a telephonic view-point, the quickness of operators' hearing, as well as the sensitiveness of receivers, could be even better judged by quantitative measurements, made with a vibration or thermo-galvanometer placed in the search-coil circuit by plug-switch P, shown in the sketch. By this means a chosen limit of hearing could be determined and specified in micro-watts. In this case the actual values of the operating currents in the inductor coils need not be known.

THE DEMAND FOR A BRITISH EMPIRE TRADE MARK.

The false marking of foreign-made goods with a British trade mark is a crying evil. Judging from the complaints on this score, it would seem that the practice is on the increase rather than otherwise. It is a compliment to the quality of British manufactures, and to the reputation that they have gained in all parts of the world, but of what value is that? It is a stab in the back to palm off as of British manufacture something of distinctly inferior quality which spoils our reputation, while taking the business away under false pretences. The organised efforts that have been made during the last year or so to lessen the practice, have our wishes for complete success, but unfortunately the remedy does not lie altogether in the power of the British nation. If it did, it would have been applied long ago. We require the co-operation of other Governments in the setting up of suitable legislation in all countries to deal with the evil. The question is, to what extent will that co-operation be forthcoming? We might even go so far as to confiscate all falsely marked goods arriving on British territory, either at home or abroad, when we are able to detect the practice, but the co-operation of other countries would even then remain all-important. Foreign Governments which already have enactments for dealing with fraud by their own subjects, will surely see little objection to imposing legislation calling for common honesty and fair dealing in trade. It is the rankest fraud to make an inferior article, say, in France or Germany, and circulate it in those countries, and in our own foreign markets, as "made in Sheffield." It is a kind of fraud that ought to have a very drastic sort of treatment. Before, however, one can hope to secure the assistance of our own and other Governments, we must be in agreement among ourselves. We are sure that our readers will recognise how important it is that, first of all, there should be co-operation between our own business men in this matter.

In March last a non-political association was formed—with the title the Register of British Manufacturers—as the result of a meeting of delegates of Chambers of Commerce and manufacturers. The objects of the society, as printed in a prospectus issued by Mr. T. Swinborne Sheldrake, the secretary, 57 and 58, Chancery Lane, W.C., were as follows:—

(*a*) To combat the fraudulent marking as British of foreign-made goods.

(*b*) To promote the sale of British manufactures in preference to foreign-made goods.

(*c*) To adopt and register for the use of members a mark or marks under Sec. 62 (standardisation) of the Trade Marks Act of 1905.

(*d*) To promote, forward, and assist the international protection of industrial property in such mark, or other marks, as may be registered as the property to the members.

(*e*) To bring to the notice of the public the risks and disadvantages to it arising from unfair practices in trade.

(*f*) To bring to the notice of the public the advantages of giving preference to goods marked by the registered manufacturers in making purchases.

(*g*) To watch the proposals and proceedings of the British Government and municipalities and other public bodies with respect to contracts, and to take such steps in reference thereto as may be deemed fit in the interests of British industries.

(*h*) To induce British Colonial Governments to grant protection for the society's mark or marks, and to extend inter-Imperial trade relations by enrolling as members the manufacturers and producers of such Colonies as are willing to give reciprocal protection for the society's mark or marks.

It is recognised that there are great practical and legal difficulties to be overcome, and that the support of representative business bodies is essential. The idea of a national trade mark is, of course, not new, for efforts were made more than 20 years ago in Sheffield, whose manufactures, as everybody knows, owing to their splendid reputation for quality of cutlery, &c., have been more imitated than others, and whose firms have, therefore, a more deeply-felt grievance. The difficulty, it is stated, lies in formulating a practicable scheme that will secure the sanction of the Board of Trade. As Mr. Sheldrake pointed out when elaborating the present proposals in a letter to the *Times*, the law of trade marks is not uniform throughout the Empire, and there must be difficulty in arranging for Colonial registration; bodies of business men commanding confidence in each colony would be necessary in order to enforce the regulations under which a national mark could be used. The Council of the Register met this difficulty provisionally by providing in their draft rules for the use of the mark by members in any Colony with the Government of which it was found possible to make arrangements for reciprocal protection. "Clearly it would be unfair to the British manufacturer to allow the use of a national mark to Colonial exporters, except in Colonies where the British manufacturer trading under the same mark was equally protected."

The President of the British Chamber of Commerce in Paris, in a recent letter to the *Times*, quoted two decisions conclusively proving that French law affords ample remedies to British manufacturers in cases where the name of their locality of manufacture (London, Sheffield, Redditch, &c.) is falsely used on goods imported into, or manufactured in, France. "For example, any hat manufacturer in London or steel manufacturer in Sheffield could attack in the French Courts the vendor of hats marked 'London,' or steel marked 'Sheffield,' which were really of French or other Continental origin." After these decisions, he holds it to be doubtful "whether the offender would even defend the action."

This same gentleman, speaking in Paris recently, said that Great Britain was practically the only country which thoroughly carried out the provisions of the Convention of Madrid with regard to the international protection of merchandise marks. The Paris Chamber had on a number of occasions aided British manufacturers in protecting their marks on the Continent.

The subject received attention at the International Congress of Chambers of Commerce in London in June last. A French delegate contributed a paper advocating a modification of Article 4 of the Madrid Convention, so as to secure the protection of all geographical designations of characteristic products of the soil, and he advocated preliminary inquiries in each country for the formulation of a list of products whose designations should be guaranteed. Mr. Kenric B. Murray asked the Congress to assist the British Empire in its efforts to procure legislation throughout the large area of its membership to deal with false marking. The principles of the Merchandise Marks Act, 1887, were now adopted and enforced by nearly the whole of the British oversea Colonies and Dependencies. The goods and local reputations of other countries were thus protected effectively wherever the British flag flew, and the time had now arrived for reciprocity to be given by the States which had so long enjoyed these advantages.

A resolution was passed recommending a modification of the Convention of Madrid in order to secure the adhesion of other countries to the Convention.

Last month the Associated Chambers of Commerce had the subject before them at Leeds, when it was resolved to urge the Government to use its endeavours to induce foreign

Powers to agree to the holding of an International Conference, with a view to the extension of the provisions of the Madrid Convention to all commercial countries of the world; also to induce such countries to adopt domestic legislation enabling them to effectively carry out the provisions of the Convention.

Last week a Conference was held in London of Colonial representatives, Chamber of Commerce delegates, and others, called together by the British Empire League to consider the question. After lengthy debate two resolutions were passed, one declaring it to be in the interests of British trade that a trade mark, to be known as "The British Empire Trade Mark," be established under proper control for the purpose of distinguishing products of the various parts of the British Empire. The other resolution was concerned with the control of such a trade mark by a Council, the manner of whose constitution was outlined.

THE RIGHT TO ALTER THE PRICE OF ELECTRICITY.

[BY OUR LEGAL CONTRIBUTOR.]

In view of the advent of the metallic-filament lamp, which enables the consumer to enjoy better light at a lower price, it is becoming necessary for supply authorities to reconsider their position. If the old rates are maintained, the shareholder and the ratepayer will be heard to complain. If rates are increased, they must be kept within the statutory limit, and they cannot be raised by any method which involves the breach of any subsisting agreement with a consumer. Having regard to the enormous importance of this question, it is proposed to discuss the statutory enactments now in force under which a revision of prices may be made, and the conditions under which an agreement with a consumer may be put an end to or modified.

At the outset, it should be pointed out that the present *impasse* is largely due to certain provisions which are to be found in the Electric Lighting Act, 1882. That Act stipulates that where a supply of electricity is provided in any part of an area for private purposes, then, except in so far as is otherwise provided by the special order, every company or person within that part of the area is, on application, entitled to a supply on the same terms on which any other company or person in such part of the area is entitled under similar circumstances to a corresponding supply. And the undertakers must not, in making agreements for a supply of electricity, show any undue preference to any local authority, company or person; but subject to this restriction, they may make such charges for the supply of electricity as may be agreed upon, not exceeding the limits of price imposed by, or pursuant to, the special order.

In the case of the Metropolitan Electric Supply Co. *v.* Ginder ((1901), 2 C.H., 799) an intending consumer signed a form of request to an electric lighting company, subject to, *inter alia*, the following terms:—(1) The consumer agrees to take the whole of the electric current required for the premises mentioned below from the company for a period of not less than five years; (2) The charge for electric energy to be 4½d. per Board of Trade unit. No quantity was specified, and there was no covenant by the company to supply, nor by the defendant to take, *any* energy. Similar forms of request had been signed by other persons for different terms of years at different prices. The company afterwards supplied another consumer under contract for two years at 4d. per unit; but he was a large consumer who took his supply in the daytime, which was an advantage to the company. It was held that this did not amount to "undue preference" under Sub.-secs. 19 and 20 of the Act of 1882, that the phrase "similar circumstances" which occurs in Sec. 19 of the Electric Lighting Act, 1882, included amount of energy consumed, the expense of supplying it and getting payment, uniformity of demand, and the fact that some consumers required energy by day, and some by night, and that unless all the circumstances were similar, agreements might lawfully be made for different terms, and at different rates.

The chief difficulty which has arisen owing to the introduction of metallic-filament lamps, is caused by another section of the Act which provides that the undertakers are not entitled to prescribe any special form of lamp or burner to be used by any consumer, or in any way control or interfere with the manner in which electricity supplied to them under the Electric Lighting Acts, and the special order, is used. But no consumer may use any form of lamp or burner, or use the electricity supplied for any purposes, or deal with it in any manner, so as to unduly or improperly interfere with the supply to other consumers. And any dispute between the undertakers and a consumer as to the matters above mentioned is to be determined by arbitration.

How, then, is a supply authority to overcome these difficulties? The maximum which undertakers are entitled to charge is not often likely to require revision. In most areas the usual flat rate is so much below the maximum, that there is sufficient margin to allow a profit even if metal-filament lamps were universally used. But at the same time, it may be necessary to obtain a revision of the maximum. The prices to be charged must not exceed those stated in the Order (usually 8d. per unit or less). The Board of Trade are, however, empowered, in the case of undertakers other than the local authority, upon due representation to them, after the lapse of five years from the commencement of the Special Order, to make an order varying the prices stated in the Special Order or approved by the Board, or substituting other prices; and the prices for the time being in force may be altered in like manner at any time after the expiration of any period of five years after they were last altered. And the Board have similar powers of varying the undertakers' methods of charge [see Electric Lighting (Clauses) Act, 1899, (Schedule) Sec. 32, as amended by the Electric Lighting Act, 1909, Sec. 10]. It follows from this that many undertakers who are now supplying electricity may have to wait a considerable time before they can hope to secure the necessary revision of prices.

The only practical method of effecting a change which will satisfy the shareholders, is to modify the terms of the consumers' agreements in such a way as to increase the general rate throughout the area. The statutory obligation of the undertakers is as follows: They must, upon the request of the owner or occupier of any premises within 50 yards from any distributing main of theirs in which they are, for the time being, required to maintain, or are maintaining, a supply of energy for the purposes of general supply to private consumers under the Special Order or the Board of Trade regulations, give and continue to give a supply of energy for those premises in accordance with the provisions of the Special Order and of those regulations; and they must furnish and lay any electric lines necessary for supplying the maximum power to which the owner or occupier is entitled under the Special Order, subject to conditions to the following effect:—

The cost of so much of any electric line for the supply as is laid upon the property belonging to the owner or in the possession of the occupier, and of so much of any such electric lines as it is necessary to lay for more than 60 yards from any distributing main of the undertakers, although not on that property, must, if the undertakers so require, be defrayed by the owner or occupier.

Every owner or occupier requiring a supply must, first, serve due notice upon the undertakers; secondly, if required by the undertakers, enter into a written contract with them to continue to receive and pay for a supply of energy for at least two years of such an amount that the payment to be made for the supply at the undertakers' then rates of charge to ordinary consumers shall not be less than 20 per cent. per annum on the outlay of the undertakers in providing any electric lines required, as above stated, to be provided by them for the purpose of the supply, and, if required by the undertakers, give them security for the payment to them of all moneys which may become due to them by the owner or occupier in respect of any electric lines to be furnished by the undertakers, and in respect of energy to be supplied by them.

A grave difficulty occurs to the legal mind in applying the law as above laid down to enable the company to effect a

universal change. In practice it has not been usual to enforce the provision that a consumer shall take a supply for a number of years. Three months' notice, or less, to determine the supply is generally all that is necessary. Now, suppose that in the case of an old consumer using metallic-filament lamps, the undertakers were to decide to determine his existing agreement and impose a new rate upon him. He would be entitled to protest (under the clauses of the Electric Lighting Acts already mentioned) unless all the consumers in the district were similarly treated. The question really is :—May the undertakers charge two rates—one for ordinary, and the other for metallic-filament lamps? Is the consumer who is using the metallic-filament lamp using current "under similar circumstances" to an old-fashioned consumer? This is a very difficult question, and its solution is not by any means rendered easier by the other section which prohibits the undertakers from prescribing a particular form of lamp or burner. Upon the whole, however, it is submitted that the undertakers may have alternate prices. The consumer who uses the modern form of lamp gets the same amount of light for the same price. In such circumstances he could not allege that he was unfairly treated.

ON THE WINNING SIDE.

By A MUNICIPAL ENGINEER.

As an engineer of a municipal undertaking already taking full advantage of its powers relating to selling and wiring work, I venture to think it may be of some interest to you to hear how one electric supply undertaking has arrived at the happy stage when it can do exactly as it wishes with regard to this matter, and at the same time keep its local contractors satisfied and willingly carrying out its wishes.

For some years I have been thoroughly convinced that in the interest of the electric supply undertaking, the present and prospective consumers, and the ratepayers generally, we must not only sell juice but also any electrical apparatus required of us by the users of electrical energy.

We desired not to compete, but to work in conjunction with the local contractors, and with this feeling predominating, the contractors were approached, and it was pointed out to them that the Corporation had invested £120,000 in providing a supply of electrical energy, also for this expenditure to remain the asset it represents in the accounts, and to maintain the interest of the citizens, every possible means must be used to obtain the greatest possible benefit for the community, and, further, that the question of the effect of the undertaking putting its powers into operation must not be looked upon from the standpoint of two or three, but from that of the general body of ratepayers.

The usual objections were raised and discussed, and the meeting ended in a friendly manner. Our next step was to get out a simple specification, and a schedule of materials used for the wiring, and a schedule for labour. These were sent to each contractor with a request that he would fill in his prices for materials and labour in accordance with the requirements of the specification, and when returned they contained prices which varied to such an extent that it was impossible to arrive at a basis on which the supply undertaking could give the work to the contractors.

We then priced the schedules and sent them to the contractors for approval, explaining the hopelessness of the schedules received from them, and the result was that our prices were accepted. When this arrangement started we used to measure the work on completion in the presence of a representative of the contractor and work out the measurements in accordance with the schedule, but eventually the contractors preferred to take the job at a specified price. This is now done, and the contractors seem satisfied with the results; however, we continue to use the schedule for estimating purposes.

There are several peculiarities to overcome in towns such as this, with a population of 50,000, and three contractors, which make it imperative that the electric supply undertaking should be prepared for this work. For instance, before we started contracting we were frequently placed in extremely stupid positions such as in private trade would not be tolerated for a single day. It would often happen that a consumer would call to inquire as to lamps, &c., who naturally assumed that we carried a stock for sale in the same manner as the gas undertaking. Imagine his surprise when informed that we did not supply that which he required, and sent him off to Mr. Contractor No. 1, 2 or 3, about half-a-mile or more in another direction.

Prejudices also exist in the minds of would-be consumers in small towns in respect to the religious, teetotal, or political opinions of the contractor they would need to employ, and owing to the knowledge that the contractor, at some time in the recollection of the would-be consumer, carried on some other kind of business, and appeared to become a wiring contractor without training of any kind.

Fortunately, the contractors in this town fully realise these prejudices, and that if they are not overcome this class of ratepayer would rather do without electricity than give way in respect to his prejudice, whatever it might be. We, therefore, have to resort to strategy. The contractors' workmen become ours for the time being, and work entirely to the instructions of the staff of the electric supply undertaking, and Mr. Contractor is not seen during the whole of any such job.

The Contractors' Association can fight this matter to-day, but assuredly they will lose in the end, owing to the natural conclusions of the users of electrical energy, who are realising more and more every day that the interest of the wiring contractor and that of the electric supply wiring department towards them are very different. The wiring contractor is seeking work to enable him to live as a contractor, whilst the primary objects of the electric supply wiring department in seeking this work are to provide inexpensive installations, consistent with low consumption of energy, which will compete with any other form of artificial lighting, and so increase and maintain the use of electrical energy, and at the same time endeavour to assure the financial stability of the money involved by the representatives of the ratepayers in providing a supply of electrical energy.

Our moral support only for the municipal electric supply systems is not because we will not spare a penny, but simply because some years ago we went to the expense of obtaining these powers on our own account, and therefore are not disposed to pay again.

Theatre Installation. — We understand that the Palladium Theatre of Varieties, which is the largest building of its kind in London, will be illuminated with a lavish hand, while hand-made electric fittings of handsome design will be installed. Some minor details are still undecided, but the fittings in the auditorium will be chiefly of the Georgian type in a dull brass finish. The main ceiling will have two 50-light electroliers, eight 10-light electroliers, and other fittings; corresponding designs of brackets, 3-light pendants, and ceiling fittings, will be employed for the fronts, ceilings, and walls, of the various circles. The stalls saloon, lounge, and landings, will be lighted by electroliers and other fittings of specially heavy Georgian design, whilst fittings of Louis XV style in gilt and crystal have been selected for the dress circle saloon. The floats, battens, hanging lengths, proscenium lights, bunches, &c., are all of the most modern types, and efficient provision has been made for the lighting of the passages, dressing rooms and other similar situations. The fittings for the interior allow for an aggregate of approximately 1,200 lights, whilst a large number of special signs and arc lamp brackets will be mounted on the exterior. Tantalum and "Onewatt" lamps and Siemens arc lamps will be employed exclusively for the lighting, and the whole of the fittings are being supplied by Messrs. Siemens Brothers Dynamo Works, Ltd. (Fittings Department), Tyssen Street, Dalston, whose own artist is responsible for the accepted designs.

Earthing Three-phase Networks.—At Frankfort, one of the phases of the three-phase network has been earthed at the generating station through a water column of 2 ohms resistance, with the result that pressure surges have been greatly diminished in frequency. The danger of leakage to earth in the network is reduced by one-third, and when a fault occurs on one of the insulated lines, the circuit-breakers are opened at once. Switches are required only on the insulated conductors. In the case of overhead lines, the earthed conductor is carried on the top of the poles, on low-pressure insulators, and is protected at intervals by low-pressure lightning arresters, thus reducing the cost of installation. The results of the system are regarded as very favourable.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

SAMOA.—Goods imported into Samoa pay a duty of 10 per cent. *ad valorem*. The following accessory dues are also payable :—

Declaration	8 marks.
Warehouse rent for every package measuring less than a cubic metre	·20 mark per month.
Warehouse rent for every package measuring more than a cubic metre	·40 " "
Porterage per package measuring less than a cubic metre...	·40 mark.
Porterage per package measuring more than a cubic metre	·80 "

N.B.—For purposes of calculation of duty, £1 sterling = 20·42 marks.

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

23,958. "Improvements relating to the control of alternating-current induction motors." M. Milch. October 17th. (Complete.)

23,963. "Improvements in electrical conduit couplings or sockets." H. Hirst and T. Taylor. October 17th.

23,973. "Improvements in or relating to electrical switches." H. W. Cox. October 17th.

24,003. "Improvements in electromagnetic relays." Siemens Bros & Co., Ltd., and L. De M. G. Ferreira. October 17th. (Complete.)

24,023. "Improvements in and relating to telephones." W. E. Evans. (Isolatoren Fabrik "Pulvolit" G.m.b.H., Germany.) October 17th.

24,038. "Improvements in electric water heaters." T. B. Gray. October 17th.

24,041. "Improvements in electric arc lamps." H. J. Booker and A. Ogilvy-Webb. October 17th.

24,064. "Improvements in electrical condensers." British Insulated and Helsby Cables, Ltd., and E. A. Bayles. October 18th.

24,106. "Improvements in and relating to electric arc lamps." H. E. Angold and J. F. Poynier. October 18th.

24,123. "Insulator for electrical purposes." Western Electric Co., Ltd. (Western Electric Co., United States.) October 18th. (Complete.)

24,143. "Improvements in high-frequency apparatus." M. Sanchez. (Date applied for under Sec. 91 of the Act, October 19th, 1909, being date of application in Spain.) October 18th. (Complete.)

24,157. "Apparatus for varying the speed of rotation of a driven shaft independently of the speed of the driving shaft." Firm R. Bosch. (Date applied for under Sec. 91 of the Act, December 10th, 1909, being date of application in Germany.) October 18th. (Complete.)

24,183. "Improved electrical system for indicating an alarm of fire or such like simultaneously at any required number of points or stations." A. W. Brown. October 19th.

24,188. "Improved electric pump." G. Poore and H. A. Harvey. October 19th.

24,201. "Improvements in tubular fuses and the like for use in electric light and power circuits on switch and fuseboards and the like." T. H. P. Colcutt. October 19th.

24,216. "Electric incandescent lamp cap." F. C. Mayes. October 19th.

24,238. "Improvements in electric heating apparatus." H. Hirst and C. H. Archer. October 19th.

24,272. "Improvements in and relating to magnetic armatures or the like." W. D. Kilroy, J. C. Needham and Eversheb & Vignoles, Ltd. October 19th.

24,286. "Improvements in magnetic separators." J. Kraus and Maschinenfabrik und Muhlenbauanstalt G. Luther Akt-Ges. October 19th. (Complete.)

24,291. "Protectors for ignition plug terminals." H. G. Longford. October 20th.

24,294. "Improved short-circuiting contact for arc lamp lowering gears." O. R. Williams and J. Stevenson. (Application for Patent of Addition to No. 3,361 of 1910.) October 20th.

24,316. "New and improved call indicator and concentrating apparatus for telegraph circuits and the like." J. P. Gorton and C. T. Pounsford. October 20th.

24,347. "Process and device for transmitting and registering verbal communications by means of the telephone." P. Perotti. October 20th. (Complete.)

24,363. "Improvements in joints for telegraph poles and the like." Bullers, Ltd., and H. Dagnall. October 20th.

24,388. "Improvements in electric time switches." G. G. Bell. October 20th.

24,390. "Improvements in telephonic transmitters." L. J. Holt and W. J. Marchant. October 20th. (Complete.)

24,391. "Improvements in internal combustion engines." J. L. Watkins and J. R. Binney. October 20th.

24,397. "Improvements in track system for switching yards." G. Prenoszil. (Date applied for under Sec. 91 of the Act, November 3rd, 1909, being date of application in United States.) October 20th. (Complete.)

24,398. "Improvements in or relating to supports for pendant incandescent electric lamp fittings." W. E. Weedon. October 20th.

24,421. "Improvements in receiving method for wireless telegraphy." W. O. Smith. (E. F. Huth, Germany.) October 21st. (Complete.)

24,423. "Improvements in devices for igniting explosive charges in internal combusion engines." W. Swaine and C. L. Bruce. October 21st.

24,424. "Improved means for controlling the ignition and extinction of gas lamps on railway trains or the like." J. Keith and G. Keith. October 21st.

24,457. "Improvements in or relating to the determination of low voltages in electric circuits." Cambridge Scientific Instrument Co., Ltd., and W. S. Peake. October 21st.

24,475. "Improvements in or relating to insulating fittings for overhead electric traction systems." E. M. Munro and Railless Traction Co., Ltd. October 21st.

24,485. "Improvements in and relating to electrical resistances." M. B. Field and Ferranti, Ltd. October 21st.

24,489. "Apparatus for actuating conduit traps and car ploughs for electric conduit tramways." D. Samaia. (Application for Patent of Addition to No. 8,863/10.) October 21st. (Complete.)

24,495. "Improvements in electric shutter indicators." J. Zickel. (Date applied for under Sec. 91 of the Act, May 2nd, 1910, being date of application in Germany.) October 21st. (Complete.)

24,498. "Improvements relating to magneto-electric machines." F. B. Lodge and A. M. Lodge (trading as Lodge, Bros. & Co.). October 21st.

24,524. "System of point-shifting mechanism for railways or tramways worked from the locomotive or the car by means of electricity." E. Piacani, O. Pacini and A. Capellano. October 22nd. (Complete.)

24,533. "Improvements in and relating to electric striking and chiming mechanism." I. H. Parsons and A. E. J. Ball. October 22nd.

24,548. "Improvements in and relating to incandescent metal-filament lamps." O. Krause. (Date applied for under Sec. 91 of the Act, July 8th, 1910, being date of application in Germany.) October 22nd. (Complete.)

24,549. "Improvements in and relating to incandescent metal-filament lamps." F. Skaupy. (Date applied for under Sec. 91 of the Act, July 13th, 1910, being date of application in Germany.) October 22nd. (Complete.)

24,584. "Improvements in or relating to electric switches and circuit-breakers." S. C. Batstone and W. J. Watson. October 22nd.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1909.

Electric Safety-Lamps for use in Mines or other like places. J. G. Patterson. 19,859. August 23rd. (Cognate application, No. 5,818 of 1910.)

Electrical Connectors. Feld Bros. & Co. and B. E. Sobotka. 20,035. September 15th. (Post-dated February 28th, 1910.)

Apparatus for Vibratory and Electric Treatment of the Body. C. Heitman. 22,072. September 28th.

Electro-Deposition of Metals. S. O. Cowper-Coles. 22,374. October 15th.

Telephones and Sound-Reproducing Devices. G. R. Webb. 22,580. October 4th.

Systems of Electric Train-Lighting. H. Leitner. 22,611. October 4th. (Cognate application, No. 3,475 of 1910.)

Electric Fire-Alarms. H. W. Headland and H. W. Headland, jun. 22,617. October 4th.

Transmitters for Signalling by Electromagnetic Waves. A. Burns. 22,640. October 5th. (Cognate application, 1,476 of 1910.)

Current Collectors for Electrically Driven Vehicles. British Thomson-Houston Co. (General Electric Co.) 24,016. October 19th.

Electrical Standard Resistances. M. Bousfield. 27,335. November 24th.

1910.

Insulating Devices. J. Steynis. 2,899. February 5th.

Electric Machine for Cutting Out Stencil Bands for Colouring Cinematograph Films. R. James. (Compagnie Generale de Phonographes, Cinematographes, et Appareils de Precision.) 2,998. February 7th.

Boxes for Containing Incandescent Gas Mantles, Incandescent Electric Lamps, and other Fragile Articles. A. H. Stevenson. 3,900. February 17th.

Ventilation of Electric Accumulator Cells. A. B. Pescatore and Tudor Accumulator Co. 4,567. February 23rd.

Systems of and Apparatus for the Control of Electric Circuits. A. H. Olmsted. 4,696. February 24th.

Telephone System and Individual Transmitter. C. L. Chisholm. 8,332. April 6th.

Attachment Device for the Distributors of Magneto-Ignition Machines. Etablissements de Dion-Bouton. (Soc. Anon.) 10,780. May 2nd. (Date applied for under International Convention, May 25th, 1909.)

Electric Contact Makers. McKenzie & Holland, Ltd., and S. P. Wood. 11,281. May 6th.

Method of Working Arc Lamps in Series with Incandescent Lamps. A. Heimann and W. Schäffer. 11,582. May 10th. (Date applied for under International Convention, November 10th, 1909. Application for Patent of Addition to No. 748 of 1910.)

Electric Lamp Holders. S. B. Freiberg. 12,609. May 24th.

Aluminium Syndicate Proposals.—It is announced that fresh negotiations have been entered upon between producers of aluminium on the European Continent with a view to the formation of a new syndicate of an international character. The negotiations, which took place in Brussels, and are to be continued in November, aim at the conclusion of an agreement for makers not to increase their production excessively, but to bring it into relation to the growing consumption of aluminium for various purposes. It remains to be seen whether the present scheme, which is said to have the support of the principal makers, will be any more successful than previous projects brought forward in the past 12 months. It is known that notwithstanding the fluctuations in prices since the collapse of the old aluminium syndicate, the large works which have auxiliary branches have been able to work at a profit taken as a whole, but those which only produce this particular metal have had to suffer from the low prices due to competition, and can only hope to find profitable employment for their enlarged works by not restricting the output, and by not forcing up prices. It, therefore, seems to be a question whether it will be possible to reconcile the interests of the latter class with those of the former. The exports of aluminium from Switzerland to Germany in the first nine months of this year amounted to 2,510 tons, as compared with 1,420 tons in the corresponding months in 1909.